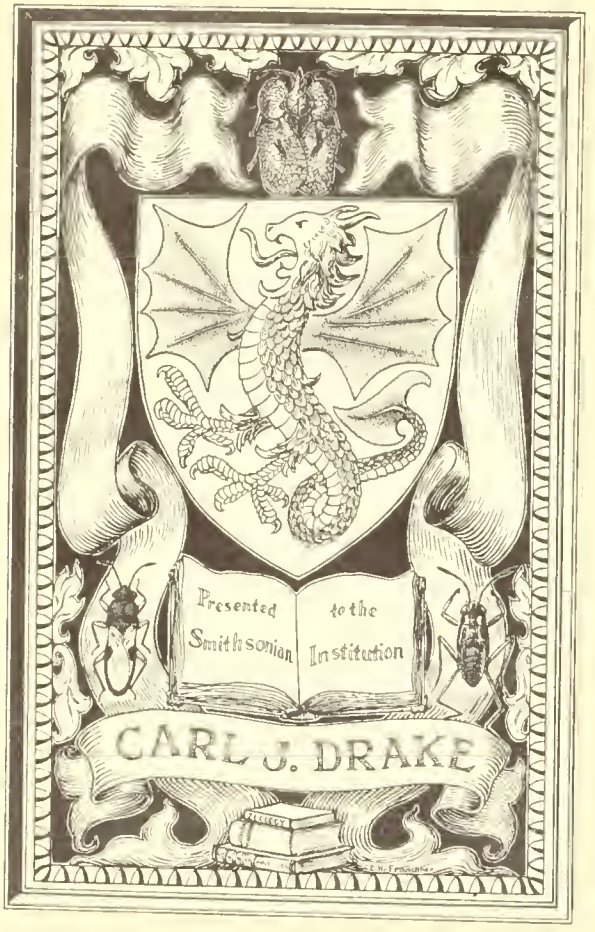
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EPHRAIM PORTER FELT State Entomologist

Memoir 8

INSECTS AFFECTING PARK AND WOODLAND TREES

BY

EPHRAIM PORTER FELT D.Sc.

VOLUME 2

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ENEMIES OF EVERGREEN OR CONIFEROUS TREES

WORK OF BARK BORERS IN PINE

It is difficult for the average reader to gain a just conception of the injurious character of these insects by a perusal of a number of detached notices of the work of associated species. It is therefore proposed to give at the outset a brief resumé of the conditions we have found in the Hudson valley. The white pines in this section have suffered seriously during the last three or four years and a considerable proportion of the damage is due to the work of bark borers and their associates. The extremely injurious character of their operations is well illustrated on plates 52, 53 and the rapid progress these pests may make is shown in figures 1 and 2 of plate 53. Figure 1 was taken Sep. 28, 1901 and figure 2 of the same trees was taken April 1902. It will be seen that these pines have been practically killed within a year and if a close examination is made we will find conditions substantially as follows:

At the very base of the trees there are a number of irregular, rather large masses of pitch and on removing these it will be found that they cover the entrance to a gallery about $^1_4$ inch in diameter. The condition within is well represented on plate 58, figure 4, which shows the preservation of the walls by the infiltration of pitch and is thus incontrovertible evidence of living tissues having been attacked. This borer, known as Dendroctonus terebrans Oliv., is a very common species in New York State where it may be met with in small numbers in almost any pine grove. It can hardly be regarded as a dangerous form though it works in living tissues. Farther up the same trees a much more serious injury is evidenced by the numerous pitch tubes on the bark [pl. 54, fig. 2]. Plate 54, figure 4, represents one in profile. The removal of a piece of bark will show the condition of affairs under the pitch tube. Plate 54, figure 3, illustrates the large central chamber underneath with five longitudinal galleries leading therefrom. Small notches may be observed on the sides of these galleries, particularly near the extremities, and these lead into

diverging somewhat sinuous larval galleries which run approximately transversely of the wood fibers. This is the work of a large borer known as Tomicus calligraphus Germ., an insect that occurs in the thicker bark of trunks and larger limbs of both hard and soft pines. It normally does not cause very much injury but under exceptional conditions it may become so abundant as to kill a tree very rapidly, so much so that the writer has known young pines, in apparently excellent condition, killed in 10 weeks' time. These borers sometimes become so abundant as to eat away practically all of the inner bark, a condition represented at plate 56, figure 3.

Farther up on the tree in the thinner bark of the trunk and the medium thick bark of the larger limbs, a smaller species may be found at work in some pines and its method of operation is well shown in plate 60, figure 3, which represents the longitudinal burrows and the larval galleries of this smaller species, Tomicus cacographus Lec. This is a very badly infested piece of bark and plate 60, figure 2, illustrates the work of this insect on limbs of hard pine which it had entered in the fall of 1900. It will be observed that these galleries are very irregular and anastomose without apparent reason. These are evidently galleries which the beetles have made for feeding purposes and in which they pass the winter.

Higher up on a white pine in the still thinner bark of the smooth trunk, a smalier form, the pine bark beetle, Tomicus pini Say, may be observed at work. This species operates not only in the trunk but also in the medium thick bark of the smaller limbs and not infrequently attacks living tissues. Plate 59, figure 1, which is from a photograph taken with a light background, represents the numerous exit holes which this species may make in a badly infested section of a trunk and also a number of small pitch tubes and plate 59, figure 2, shows the inside of the same piece of bark photographed in a similar manner. The method of operation of this species is well illustrated, the central chambers, the primary galleries and the dilating mines of the young together with larger flat tortuous mines of another species known as the pine sawyer, Monohammus con-

fusor Kirby. The parent of this latter insect is represented at plate 63, figure 1, and its operations are familiar to many lumbermen because its coarse white sawdustlike chips may be frequently observed dropping from logs piled in mill yards and its large galleries are not uncommon defects in timber. The sawyer is rarely found attacking living trees. It prefers to breed in those which are dying or nearly dead and therefore is a follower of the above noted barkborers. Other species have a similar habit, notably the ribbed rhagium, Rhagium lineatum Oliv., a species which is frequently destructive to the bark of trees previously killed by other insects. Its broad flattened grub delights to revel in moist decaying tissues and its very characteristic cells [pl. 64, fig. 7, 8, 10] are walled by long white splinters torn from the wood forming a portion of its oval pupal cell. Another species, Pytho americanus Kirby, is also associated with the preceding in this work of reducing decaying tissues to a still finer condition. It may be easily recognized by its oval cells which instead of being bordered by linear chips torn from the surface of the wood are lined with nearly decayed debris from the bark [*see* pl. 64, fig. 6, 9].

These two species in conjunction with the bark borers soon reduce the inner tissues of an attacked tree to a mass of decayed vegetable matter and render the stripping of the bark an easy matter. Plate 56, figure 2, illustrates the secrecy of these operations very nicely. Apparently the trunk of the tree has suffered little or no injury, but on removing the bark its inner layers are found to be a mass of corruption, as shown at plate 56, figure 3. The bark loosens and soon drops in large patches, exposing the wood to other enemies such as ambrosia beetles.

The condition of such a tree which scarcely two years before it was photographed was in full vigor, is well shown at plate 54, figure 1. The small black holes in the bare wood are entrances to galleries of wood borers known as ambrosia beetles and these lead into lateral galleries from which in turn there are series of perpendicular chambers. This latter insect, Xyloterus bivittatus Kirby, is common in soft woods and is

injurious on account of its making small black walled galleries which materially lower the market value of infested lumber.

CERTAIN STRUCTURES OF SCOLYTIDS

Scolytid beetles are so small and present such slight differences in general form, that a study of minor structural details is absolutely necessary for the adequate separation of species, unless we rely largely on food habits, something which is not always practical. Color has very little value and as a consequence we have felt obliged to give some attention to structural details, in spite of the fact that a distinguished authority on this group is engaged in a comprehensive study of these beetles.

The classificatory value of the antennae has long been recognized. They vary widely in character, as has been pointed out by earlier writers, though to our knowledge no one has figured these organs in many of our native species. The exceeding variability in structure is well illustrated by reference to plate 67, figure 1, showing the single jointed funicle of Monarthrum mali Fitch, unique in this extremely interesting group. The strongly flattened and enormously dilated club or terminal segment of Chramesus hicoriae Lec. is extremely characteristic. The two antennae of Scolytus, S. rugulosus Ratz. and S. quadrispinosus Say [pl. 67, fig. 10 and 15] are peculiar on account of the dark colored, triangular, chitinous structure in the club. The lamellate antennae of Phloeotribus liminaris Harr. and P. frontalis Oliv. [pl. 66, fig. 1 and 3 respectively] are very different from those of other scolytids. The disposition of the sensory areas on the expanded club of the various species of Tomicus, is of considerable specific value [pl. 66, fig. 4–9 inclusive], while the general structure of the antennae of Dendroctonus [pl. 66, fig. 10] appears to be very characteristic of this genus.

The tibiae of various species also present characters which are of considerable value in the separation of different forms, though we should expect to find more or less variation in the number and development of the minor chitinous tubercles or processes. The closely allied species of Dryocoetes, D. eichhoffii Hopk. and D. autographus Ratz. vary sufficiently, so that they can be recognized by this character alone. Chramesus hicoriae Lec. has a very peculiar middle tibia, and the two species of Scolytus are remarkable for the development of a large terminal process opposite the attachment of the first tarsal segment [fig. 47]. Various species of Tomicus may be recognized by tibial characteristics, and Xyloclepes possesses a very peculiar femur and tarsus. Phloeosinus dentatus

Say may be instantly recognized by the distal margin of the hind tibia being thickly set with stout, chitinous processes.

The structure of the so called gizzard or proventriculus is exceedingly interesting in this group, most of the species differing markedly in this respect from their allies. The employment of this organ in systematic work is not new. It has been used by myrmecologists and Dr J. B. Smith, in a report issued a few years ago, calls attention to the fact that various species of katydids present recognizable differences in this organ. The structure of the Scolytid proventriculus is exceedingly interesting. It consists of a series of eight double, rectangular plates, the posterior extremities of which are provided with a series of long, chitinous, hairlike processes, undoubtedly serving as strainers to prevent the entry into the true or chyle stomach, of untriturated material. An end view of this organ is given on plate 68, figure 1, and plate 69, figures 2, 5, each of which shows the octagonal structure and the first named, the strainerlike hairs probably in the normal position. There are several well marked types of proventriculi. That of Tomicus, shown on plate 68, illustrates a highly developed form in which the anterior portion consists of a series of plain, chitinous basal plates interlocked more or less perfectly by a series of marginal teeth, while the posterior part is narrower, strongly ribbed with chitinous bars and in addition, provided with a series of long, slender, chitinous processes, which undoubtedly serve as strainers as stated above. This type is also found in Pityogenes and Dryocoetes. Dendroctonus [pl. 68, fig. 7] has a simpler form of proventriculus, consisting of a series of eight double plates, in the walls of which are numerous chitinous points placed in more or less irregular rows. The posterior portion is provided with a series of stout, chitinous rods which terminate at the free margin in tufted processes and long, slender, chitinous rods, which latter evidently serve as strainers. A modification is seen in the proventriculus of Phlocosinus dentatus Say [pl. 69, fig. 4]. Another type, intermediate perhaps between that of Tomicus and Dendroctonus or Phlocosinus, is found in Xyleborus, Xyloterus and some other genera. It consists of the usual double plates, each provided along its length with a series of stout, chitinous bars terminating in a stout, dense structure composed apparently of fused ends and at the posterior extremity there are a number of long, slender, chitinous processes which unite to form a strainer. The differences in this organ between closely allied forms, are very nicely shown on plate 68, figures 2, 3, 6 and 8, and plate 69, figure 10, which illustrate portions of the proventriculus of certain species of Tomicus. It will be seen that no two are alike, though all present a general resemblance one to another. The illustrations of the proventriculus of Dryocoetes autographus Ratz., and D. eichhoffii Hopk. [pl. 69, fig. 9 and 11] also bring out this point nicely, there being a marked difference in the toothing of the anterior portion of the plates.

ENEMIES OF EVERGREEN OR CONIFEROUS TREES

Borers in trunk and wood

Large, brownish pitch masses on pine trunks

Pitch mass borer, Parharmonia pini, p. 341

True bark borers

Masses of pitch at the base of large pines, usually indicate the presence of a stout, brownish beetle about 3/10 to 1/4 inch in length which, with its grub, bores the inner bark..... ..... Turpentine bark beetle, Dendroctonus terebrans, p. 342

A rather stout, brownish or black, cylindric beetle, about 1/4 inch in length, makes more or less longitudinal burrows in the thicker bark of the trunk and larger limbs of various pines ..... Coarse writing bark beetle, Tomicus calligraphus, p. 345

A light brown or nearly black beetle about 5/32 inch in length, bores the thicker pine bark near the middle portion of the trunk and that of the larger limbs

Pine bark beetle, Tomicus pini, p. 351

A brown or nearly black, cylindric beetle about 1/6 inch in length, works in the inner layers of thicker pine bark, particularly about the middle part of the trunk and on the underside of the limbs of larger trees..... Tomicus caelatus, p. 354

A small, brown or blackish, cylindric beetle about 1/8 inch long, bores the thicker bark of smaller pines and that of the limbs of larger trees

Southern Tomicus, Tomicus cacographus, p. 356

A minute, dark bark beetle about 1/16 inch long, makes short, sinuous mines in the bark of spruce and pine..... Minute spruce bark beetle, Crypturgus atomus, p. 359

A rather stout, brownish or black beetle, about 3/16 inch long, makes longitudinal galleries in the inner bark and outer sapwood of living spruce.

Spruce destroying beetle, Dendroctonus piceaperda, p. 379

A light brown or black, rather stout beetle about 3/32 inch in length, makes somewhat irregular, transverse galleries in inner spruce bark, from which diverge smaller dilating larval galleries..... Spruce bark beetle, Polygraphus rufipennis, p. 386

Balsam trees with red tips may be infested by a small, brownish or black beetle about 1/8 inch in length which, with its larvae, runs numerous galleries in the inner bark and sapwood..... Balsam bark borer, Tomicus balsameus, p. 375

A light brown or black beetle about 1/16 inch long, makes peculiar, clubbed, longitudinal galleries under the bark of red cedar

Red cedar bark beetle, Phloeosinus dentatus, p. 391

Large bark and wood borers, sawyers and their associates

Large, white, fleshy, legless grubs from about ½ to 1½ inches long, may be frequently found working in the inner bark and sapwood of dead and dying pines, spruces, balsams and also in cut logs from these trees, produce the following:

A magnificent grayish beetle finely mottled with light brown and ranging in length from ¾ to 1½ inches..... Sawyer, Monohammus confusor, p. 360

A uniformly black beetle mottled with white and with a white scutellum, about ⅝ inch in length.. White spotted sawyer, Monohammus scutellatus, p. 364

A brownish, mottled, cylindric beetle about ½ inch in length and with very long, slender antennae..... Tickler, Monohammus titillator, p. 365

A large beetle about ⅞ inch long, with light grayish wing covers mottled with brown and dark spots..... Marbled sawyer, Monohammus marmoratus, p. 366

Smaller white grubs working in decaying bark, never entering the wood.

A white, broad headed, flattened grub occurs in considerable numbers on the bark of dead pines, transforming to a gray, black marked beetle with conspicuous ridges on its wing covers..... Ribbed pine borer, Rhagium lineatum, p. 366

A smaller, less flattened grub producing a small beetle with a black head and thin, dark bluish wing covers ..... Pytho americanus, p. 368

Flattened, white or yellowish spotted beetles about ⅜ inch in length, occur on spruce and hemlock in July, and are the parents of a destructive flat headed borer

Spotted buprestid, Melanophila tulvoguttata, p. 390

Smaller wood borers

A rather stout, brownish black beetle about ½ inch long, attacks exposed wood of various coniferous trees..... Spruce timber beetle, Xyloterus bivittatus p. 369

A brownish black, rather slender beetle about ⅓ inch long, enters the sapwood of dying and dead white pine, making cylindric galleries, with black stained walls.

Eastern pine wood stainer, Gnathotrichus materiarius, p. 371

Small bark and wood borers working in the inner bark and outer sapwood and forming rather irregular galleries in dead limbs

Pityophthorus and Pityogenes (several species of each), p. 372–375

Twig borers

An oblong, oval weevil about ¼ inch long, frequently deposits eggs in the leading shoots of pine or other evergreen trees. The grubs work in the shoots and kill them, causing an irregular, deformed tree of little commercial value

White pine weevil, Pissodes strobi, p. 307

Two larger forms occasionally taken with the above, are much rarer

Pissodes dubius and P. affinis, p. 401, 402

Two small, jet black weevils not over $^{3}/_{16}$ inch in length, are occasionally abundant in association with the white pine weevil

Magdalis perforata and M. alutacea, p. 402

Short brown needles on the tops of hard pine, specially if there be a small pitch mass near the base of the tree, is an indication of the work of this insect

Pine tip moth, Pinipestis zimmermani, p. 403

Small yellowish larvae infest the new growth of several pines, spinning a delicate web around the bud and mining both the twig and bases of the leaves

Nantucket pine moth, Evetria frustrana, p. 405

An associated similar species is much rarer

Pitch pine Retinia, Evetria rigidana, p. 407

Masses of pitch usually on the upper side of the smaller limbs and twigs of hard pine, cover the entrance of a burrow made by a small, yellowish white caterpillar about $^{1}/_{2}$ inch in length..... ... Pitch twig moth, Evetria comstockiana, p. 407

Footless orange grubs occur in colored or whitish pitch masses on the underside of pitch pine branches..... .. Pitch midge, Cecidomyia resinicola, p. 410

Insects affecting the leaves

Dirty, yellowish, red headed, black spotted false caterpillars feed in clusters on the outer branches of pines from which they strip the leaves

LeConte's sawfly, Lophyrus lecontei, p. 413

Yellowish, black headed, black spotted, false caterpillars nearly an inch in length, defoliate white and hard pines from midsummer till late fall

Abbott's pine sawfly, Lophyrus abbotii, p. 414

Clusters of black headed, dark green, dark striped false caterpillars about $^{1}/_{2}$ inch long defoliate fir, spruce and pitch pine..... Fir sawfly, Lophyrus abietis, p. 415

Spruces dying in masses or clumps of greater or less extent are very likely affected by this species..... Spruce bud worm, Tortrix fumiferana, p. 416

A greenish yellow sawfly caterpillar frequently defoliates larches in midsummer

Larch sawfly, Lygaeonematus erichsonii, p. 418

Shortened, deformed needles of pitch pine having a basal enlargement occupied by a thick, orange colored larva

Pine needle gall fly, Cecidomyia pini-rigidae, p. 423

Pitch-mass borer

Parharmonia pini Kellicott

Large brownish pitch masses on pine trunks may be caused by this borer.

This species is one of the more common pine borers and evidences of its work are by no means rare in the vicinity of Albany. Its recorded distribution is given as Canada, New York, New Jersey and New Hampshire. The life history of this species has been worked out very fully by the late Dr Kellicott, its describer, and the following is taken largely from his account.

Description. *Male.* Head, palpi, antennae, thorax, and legs wholly metallic blue or green black. Collar edged with orange in front. Abdomen blue black above, with the posterior half of the fourth segment orange; underside wholly orange. Anal tuft orange, blue black above in the middle. Fore wings opaque, metallic blue or green black with discal mark somewhat deeper in color. Hind wings thinly covered with blue black scales; outer border very narrow, blue black.

Female. Same as the male.

Expanse: male and female, 28–30 mm (Beutenmuller).

Life history. The larvae occur more frequently than elsewhere just below a branch, sometimes about the border of a wound made by the axe, or where a limb has been wrenched off by the wind, rarely in the axils of the branches. It appears to attack larger trees than Zimmerman's pine pest and more frequently occurs at a considerable hight, having been taken 30 to 40 feet from the ground. While the larvae as a rule probably take advantage of the broken cortex, Dr Kellicott found instances of where they had worked through the bark into the soft layers. Pupae are to be found the last of May and the moths appear from the middle to the end of June and possibly others come forth in July and August, for Dr Kellicott found seemingly fully grown larvae in July, though some apparently mature caterpillars taken July 15th remained in their pitch cells unchanged till the following November.

According to the observations of Dr Kellicott three years are required, in some instances, to complete the life cycle. The larvae run more or less

transverse rather tortuous galleries in the inner bark and sapwood, thus causing a copious exudation of pitch which is the most tangible evidence of their presence in a tree. Pupation occurs within the mass of pitch and just prior to the emergence of the moth, the pupa wriggles itself partly out of this sticky medium and is thus in a position to release the adult so that it may not become smeared with the pitch [pl. 45, fig. 4.]. Dr Kellicott bred a dipterous parasite from this species and as the larva frequently moves through the pitch and is almost always within its pitchy burrows, it is somewhat difficult to understand how a parasitic fly could get at such a host. The excrement of the larvae is mixed somewhat with pitch and the caterpillar apparently moves through this substance as easily as some others through water.

Turpentine bark beetle

Dendroctonus terebrans Oliv.

Masses of pitch at the base of large pines usually indicate the presence of a stout brownish beetle about 3/16 to 1/4 inch in length which, with its grubs, bores the inner bark.

This species is very common in New York State judging from collections in various localities, and the masses of pitch occurring at the base of larger trees is a most characteristic sign of its presence. A number of grubs and larvae of this species were found working in the living tissues at the base of hard pines at Manor L. I., in 1900. The insect was observed in the vicinity of Albany the same year and in 1901 at Round Lake and other localities. Pitch may be found flowing slowly from the wounds the latter part of the summer and pitch tubes on adjacent parts of the tree give additional evidence to the liking of this beetle for living tissues. Tomicus cacographus Lec. was observed working in large numbers in hard pines infested by this borer on Long Island and in the Hudson river valley. Tomicus calligraphus Germ. and some smaller species were found working in the trunk and limbs of trees infested by this insect. In no instance has the writer been able to trace very serious injury to the work of this borer. The greater part of the damage appears to have been done by species of Tomicus.

Early history. This species was observed by Dr Harris and he states

that its larvae are common under the thick bark of pine logs and stumps. Dr Fitch notices this insect briefly and evidently considered it one of the common species in New York State. Dr Packard records the occurrence of larvae and immature beetles in abundance at Brunswick Me., in the middle of March. Dr A. D. Hopkins states that this insect was very common in West Virginia from 1890–94, when it attacked all the pines and Norway spruce, working near the base of living and dying trees and in stumps. He also observes that it is widely distributed.

Description. The adult is a rather stout brownish beetle from about 3/16 to 1/4 inch long. It is probable that in a large series there would be



Fig. 64 Dendroctonus terebrans (after Hopkins)





considerable range in color, as is the case in many other bark beetles. The jaws are black, the eyes are finely granulated and the head and thorax thickly and somewhat coarsely punctured. The wing or elytra are striated and somewhat coarsely punctured. The general form of the beetle and certain structural details are shown in figure 64.

The pupa is white, quite stout and about 1/4 inch long. The lateral edges of the abdominal segments are each provided with a rather stout fleshy spine tipped with a dark chitinous point. A pair of similar spines are found on the last segment and smaller, scattering ones on the dorsal

surface of the abdomen. Three segments project beyond the tips of the wing pads.

The grub is a stout, brown headed, white larva about 3/8 inch long. The tips of the mouth parts and adjacent sutures are dark brown or black. The most prominent characteristic of this grub is the group of seven dark, chitinous spines on the horny anal plate. They are arranged as follows: an anterior transverse row of three, two wider apart behind and between these latter two, two others, one in front of the other [fig. 66].

Life history. The life history of this insect has received considerable attention at the hands of Dr Hopkins who states that hibernating adults commence to fly in the latitude of Morgantown W. Va., as early as Ap. 20 and that all have emerged by May 10. Beetles from hibernating pupae and larvae emerge later. He records an instance when this beetle appeared in immense swarms soon after emerging from winter quarters and states that many were attracted by recently painted buildings and furniture shops, freshly sawed pine, lumber, etc., by the odor of turpentine.

Dr Hopkins states that this insect prefers to enter the bark of dying trees or the stumps of recently felled ones and that it will attack healthy trees only when it has no more favorable conditions. He finds that it shows a decided preference for the living bark at the base of trees and stumps and even the exposed roots, in which it excavates broad galleries.

It rarely breeds in the bark of logs. Dr Hopkins states that the primary gallery is usually extended longitudinally both above and below the main entrance, seldom in a lateral direction, though the secondary or drainage galleries may do so. Along the sides of the main or secondary galleries 20 to 40 eggs are placed in a mass and when the larvae emerge they proceed in a body to feed on the bark before them, working side by side. Plate 58, figure 4, illustrates a primary gallery of this species and shows how the walls have been preserved by the infiltrating pitch. The young grubs were working from one side of this gallery and had eaten out an irregular area of considerable size.

Dr Hopkins states that the first egg depositing period extends through

the month of May and that larvae are found in abundance from the first of June to the beginning of winter. Pupae commence to appear early in July and may be found from then till winter. The adults of the first brood develop about the middle of July and emerge in August or possibly late in July since he has found young larvae by Aug. 10. Late in the fall all stages occur in the bark of infested trees and often in the bark of the roots as much as 6 inches below the surface of the ground.

These observations agree very closely with our own in this section as large numbers of eggs were found by us at Round Lake, Sep. 20, 1901. The observations of Dr Hopkins indicate that there are at least two broods in West Virginia and the same appears to be true for the latitude of Albany.

Dr Hopkins states that he has observed a clerid, Thanasimus dubius Fabr., attack and kill this large bark beetle, and he records finding large numbers of the beetles in the stomachs of brook trout caught in Randolph county, W. Va. the latter part of May.

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Coarse writing bark beetle

Tomicus calligraphus Germ.

A rather stout brownish or blackish cylindric beetle, about ¼ inch in length, makes more or less longitudinal burrows in the thicker bark of the trunk and larger limbs of various pines.

This is one of the largest and commonest species of the genus found on or in the thick bark of our native pines. Its operations have been observed by the writer in many localities in and about Albany during the seasons of 1899–1902 and in some instances at least it appeared to be an active partner in causing very serious injuries to these trees.

Early history. This species was noticed by Dr Fitch in his fourth report under the common name of fine writing bark beetle, but as this is hardly characteristic of the work of this borer, the writer has preferred to use the more pertinent common name employed by Dr Packard. Dr Fitch states that this beetle occurs mostly in the pitch pine in New York State and that he has also met with it in the limbs of aged white pines. Dr Packard records the work of this insect under the bark of the southern pitch pine at Houston Tex., where it appeared to be abundant and Dr Hopkins in more recent years has taken the insect in various localities in the Western States. He finds that it is a common and widely distributed species over the greater part of the pine producing areas of the United States from the Atlantic coast to and including the Rocky mountain region.

He adds that it attacks all of the eastern and southern pines and doubtless several of the western species in addition to the rock pine in which he found it in large numbers in the Black Hill region.

Description. The beetle is about $^1_4$ inch in length and varies in color from a light brown to nearly black. It is rather stout, cylindric and the conspicuous excavation or declivity at the posterior end of the wing covers is bordered on each side by a row of six teeth or chitinized processes [fig. 67]. The teeth are arranged on each wing cover as follows: a minute tooth a little to one side of the median line, a dorsal subequal pair, a minute tooth between them and the two teeth of nearly uniform hight near the ventral margin of the declivity. The prothorax is thickly and rather finely granulated while the wing covers are marked with rows of closely set rather large punctures. The general form of the beetle and the sculpturing of the dorsal surface are shown in the accompanying figure. The antennae are represented on plate 66, figure 8.

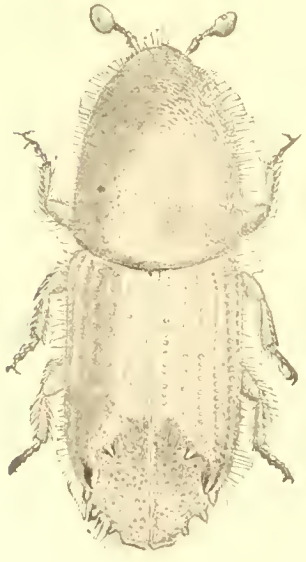
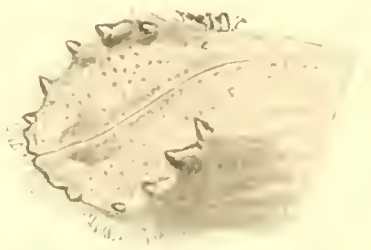


Fig. 67 Tomicus calligraphus (author's illustration)

The white pupae are found in oval cells in

the bark. They are not quite so large as the beetle, having a smaller transverse diameter and tapering very much to the posterior extremity. Two or three of the abdominal segments usually project beyond the tip of the wing covers. As the pupa advances in age, the white becomes yellowish and the mandibles may be a dark brown.



The full grown larva is a brown headed grub about $^{3}/_{16}$ inch long when normally extended. It body is rather stout, usually slightly curled and there is frequently a considerable thickening in the thoracic segments. Portions of the mandibles and the borders of adjacent sutures are dark brown.

The galleries of this borer are very characteristic and frequently afford one of the readiest means of recognizing the insect. The exterior signs of its presence may be limited to numerous circular holes about $^{1}/_{8}$ inch in diameter or very few of these may be found. This latter occurs in cases where the beetles have entered the bark in large numbers but have not emerged. The entrance is usually effected under a projecting scale of bark and is therefore not conspicuous, while many of the exit holes [pl. 50, fig. 1] occur on the prominent ridges and are therefore very easily detected. This species under certain conditions attacks living tissues and in that event the presence of the borers is indicated by brownish or whitish pitch tubes which may be nearly $^{1}/_{2}$ inch in diameter and almost that in hight. One of these structures is represented [pl. 54, fig. 4] and a close examination would show that it was built up with particles of pitch from the burrows. Plate 54, figure 2, shows a pine trunk with a number of pitch tubes indicating that the tree was alive when attacked. These pitch tubes are located, as a rule, over the entrance or nuptial chamber, from which the females make their galleries, usually following along the grain of the bark.

Plate 54, figure 3, shows one of these nuptial chambers on the inner side of the bark and represents the seven female galleries, three extending

down and four upwards. In the farther portions of the galleries are series of expanding larval burrows. It will be seen that these are placed at somewhat regular intervals and are due to the fact that the female gnaws small chambers at these points and places an egg in each. Sometimes eggs are deposited very largely on one side of the gallery and at others on both sides. The larval galleries dilate gradually, with the growth of the young, have a somewhat serpentine course and end in an oval pupal cell. They form perfect mazes of interlacing burrows when at all abun-



Fig. 69 Middle tibiae: *a*, *b*=Dendroctonus terebrans, the former from Karner, the latter from Manor; *c*=Tomicus calligraphus (original)

dant because the galleries of the young of different females may interfere more or less. It frequently happens that the beetles are so abundant as to eat away a considerable proportion of the bark and plate 55, figure 3, shows this condition very nicely and figure 1 on the same plate represents the same thing in a more advanced stage. The condition of the trunk of the tree after it has harbored large numbers of these borers is shown on plate 54, figure 1. It will be seen that all of the bark has dropped from the trunk and that many very shallow grooves have been made in the surface

of the wood, indicating that this species burrows very largely in the inner bark. The work of this insect is sometimes inconspicuous. Plate 50, figure 2, shows the base of a tree, the inner bark of which has been thoroughly riddled by this borer, as shown on plate 50, figure 3, while it will be seen that nothing but decaying borings lies between the outer bark and the surface of the wood. The few exit holes on such a tree are shown on plate 56, figure 1. The galleries of this insect are sometimes preserved for indefinite periods and constitute unimpeachable records of injury to living trees. Plate 55, figure 4, shows an elongated piece of bark with a series of longitudinal well preserved burrows which have been kept from injury by insects usually following Tomicus because their walls were infiltrated with pitch, conclusive evidence that the tissues were living at the time this bark borer attacked the tree. The same thing is shown more plainly in plate 56, figure 2. It will be observed that the burrows on either side of these preserved channels have been almost entirely obliterated by insects which follow the original invaders. Plate 60, figure 4 shows how the Tomicus burrows may be obliterated by Rhagium lineatum Oliv., a species living in decaying bark. The work of this scolytid in conjunction with other forms to be noticed later is well shown on plate 53, figure 1, which represent two pines photographed Sep. 28, 1901. It will be observed that the tip of one has very little foliage and as a matter of fact it was entirely dead at that time. The lower limbs, however, were thrifty and green and though insects were working in the trunk the tree still appeared to be vigorous. The other tree in the photograph bears rather abundant foliage and showed very little evidence of weakness, though it was somewhat injured at that time by the borers. The same trees are represented at figure 2, as they stood Ap. 28, 1902. It will be observed that the tree with a dead tip the preceding September has been entirely killed and that very few needles are to be seen on the other one, which showed comparatively little injury the preceding fall. Both are dead and are evidences of the rapidity with which this insect and its associates may work. Plate 52 shows a somewhat familiar condition in the vicinity of

Albany where a considerable proportion of narrow strips of pine have been killed by this and related bark borers in recent years.

Life history. The development of this insect requires about 10 weeks. Aug. 5, 1901 a slender pine was observed in which this species was entering in large numbers. The needles were somewhat thin at that time, pitch tubes were rather abundant and many small masses of pitch were to be found on the foliage of surrounding shrubs. The beetles were running their primary galleries at this time, the bark of the tree was alive along practically its entire length, and many eggs were being laid by the beetles. About eight weeks later, or Sep. 26, two thirds of the needles were brown and the remainder were changing rapidly. Oct. 16 practically all the needles were brown and dead, the bark had been killed and its inner layers consisted of little else than borings. Practically all of the living Tomicids had forsaken this tree though some were found in those near by. During this short time the entire life cycle was completed as the inner bark had been entirely destroyed by the work of beetles and grubs. Dr Hopkins states that Hister cylindricus Payk is a common predaceous enemy of this species.

Habits. It is not intended by the above account to give the impression that this insect normally attacks living trees, but the evidence submitted above proves conclusively that, under certain conditions, it may and does cause serious injury. It is undoubtedly true, as stated by other writers, that this species, like some of its allies, attacks by preference diseased or dying trees and that only when it becomes exceptionally abundant is there danger of its injuring healthy pines. The writer has observed this insect in the vicinity of Albany where it has caused more injury to white pines than to the equally abundant, though smaller, hard or pitch pine. The latter occurs almost entirely on Long Island and therefore this species can attack no other pine in that section.

Preventive measures. There is very little that can be done for trees which have been attacked by this and related borers other than cutting and burning the infested parts before the beetles have emerged. If this cutting

is done at the time the insects are all in the larval or grub state, it will be sufficient if the bark is stripped from the trees and allowed to dry. This will kill practically all the insects, but in case there are considerable numbers of beetles present, it would be wiser to destroy them at once by burning.

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Pine bark beetle

Tomicus pini Say

A light brown or nearly black beetle about 5 32 inch in length bores the thinner pine bark near the middle portion of the trunk and that of the larger limbs.

This species is about the same size as Tomicus cacographus Lec. and similarly it is frequently associated with larger forms, specially with Tomicus calligraphus Germ. It appears to confine its attack largely to the white pine though it has been recorded from spruce and larch.

This borer was breeding in large numbers Aug. 18, 1901 at Saranac Inn in a small dying white pine about 18 inches in diameter. The tree was abundantly infested about midway of its hight and a few beetles were found almost at the top and nearly to the base. This species occurred Sep. 15 in considerable numbers under the bark of the upper portion of the trunk and on the underside of the larger limbs of a large dying white pine at Lansingburg. This tree was also attacked by Tomicus calligraphus Germ. which was exceedingly abundant in the thick bark near the base of the trunk. Practically the same conditions as described above were found at Bath-on-Hudson, across the river from Albany, except that the attack was more advanced. This form was also concerned in the death of a number of

white pines at Round Lake N. Y. in the summer of 1901. The destructive work of this little borer was further evidenced by a complaint from Jeremiah Day, Catskill N. Y., December 1901, to the effect that 50 young white pines about 25 or 30 years old had been killed during the preceding summer and the examples of the injured bark proved that this species was the depredator. It is very evident that this little borer can seriously injure if it does not kill a tree outright. It was met with on pine and tamarack at Big Moose N. Y., July 8, 1903, evidently attracted to the recently burned trees.

Description. The beetle is slightly larger than Tomicus cacographus Lec., being about $^{5}/_{32}$ inch long and usually a little stouter. It varies in color, like the preceding, from a light to a very dark brown. One of the most prominent characteristics of this species is the presence of but four teeth on each side of the conspicuous posterior excavation or declivity of the elytra. They are arranged as follows: the dorsal one near the median line is minute and sometimes wanting in the female; the second and third are larger, specially the latter, and touching at the base; the fourth is much smaller and independent. The prothorax is rather coarsely granulated and the elytra or wing covers are ornamented with longitudinal rows of rather small punctures. The antennal structure is shown on plate 66, figure 7 and that of the tibia in figure 71*a*.



Fig. 70 Declivity of Tomicus pini (author's illustration)

Life history and habits. The typical form of the burrows of this insect is well shown in plate 57, figure 3, which represents the central or entrance chamber and an adult gallery. The latter is about $^{1}/_{10}$ inch in diameter, and leading therefrom are somewhat tortuous expanding larval mines, rarely more than $^{1}/_{2}$ inch in length. The specimen of bark photographed shows also the work of what is probably a young Monohammus larva. It will be seen by an examination of this figure that, in this case at least, two females continued their work from the central chamber, one going up and the other down approximately parallel with the bark fibers. A more advanced

stage of this insect's work is shown at plate 57, figure 2, which represents a portion of a female gallery together with a great many very irregular larval mines, several pupal cells and a few exit holes. This insect and its relatives may cause considerable injury to the inner bark without any very perceptible exterior signs. Plate 57, figure 1, represents a portion of pine bark, the inner surface of which has been badly mined by this borer. The early work of this species is shown on plate 58, figure 1, 2.

The work of this species in the thinner bark of the middle portion of a young pine is well shown on plate 59, figure 1, 2. The view of the inner aspect of the bark [fig. 2] shows the galleries of the Tomicus very plainly indeed and also the broader shallow workings of young Monohammus larvae. A great number of exit holes are represented in figure 1 by the light spots. Both of these illustrations were taken with a light background, consequently the exit holes appear as white spots.

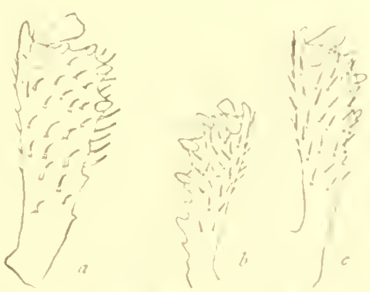


Fig. 7[illegible] [illegible]

Dr Fitch has noticed this insect and he states that the adult burrows have some resemblance to the fingers of a hand spread apart or to the track of a bird, in that they diverge from a common center and run up and down the tree. He states that this insect may be found under the bark of old white pines.

Prof. A. D. Hopkins records this species as exceedingly common in the bark of white pine in West Virginia and observes that it attacks all other kinds of pine in that State. He has also found it in both the larch and black spruce, but not so commonly as in the pine. In May and June 1897 he found it quite common excavating egg galleries in the living bark of black spruce and his observations led him to conclude that under favorable conditions it might prove a very destructive enemy of this tree.

Preventive measures. Methods of service in controlling the preceding species will also prove valuable in checking this borer.

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Tomicus caelatus Eich.

A brownish or nearly black cylindric beetle about $\frac{1}{16}$ inch in length may be found working in the inner layers of thinner pine bark, particularly that of the middle portion of the trunk and on the underside of the limbs of larger trees.

This borer, like Tomicus cacographus Lec. and T. pini Say is frequently associated with the larger and very common T. calligraphus Germ. and like the other small forms prefers the thinner bark of smaller trees or that of the upper portions of the trunk of larger ones. This bark beetle has been characterized by Dr Fitch as one of the most pernicious of all the insects infesting our white pine forests and the yellow pine in the Southern States. He adds that while most of the larger borers may attack old and decaying or dead trees, this small insect is liable to invade those that are in full health and vigor and young trees as well as older ones.

This species is stated by Dr Hopkins to be very common in West Virginia in partly living bark, on living, dying and dead, standing and felled trees. He adds that it infests all of the pines and the native and introduced spruces and that it is widely distributed. He has found Hister cylindricus Payk in the galleries of this species.

This beetle was found at work in balsam in company with Tomicus balsameus Lec., in hard pine with T. calligraphus Germ. and T. cacographus Lec., in white pine with T. calligraphus Germ. and T. pini Say and in spruce with Polygraphus rufipennis Kirby. It was also taken on spruce and tamarack at Big Moose N. Y., Aug. 3, 1903, probably attracted to the recently burned trees.

Description. This is another medium sized Tomicus, being about $\frac{1}{8}$ inch in length, cylindric, and varying in color from a light to a very dark

brown. It is a little shorter and more slender than Tomicus cacographus Lec., the posterior, dorsal portion of the wing covers is more hairy and the declivity is not so well marked. There are three principal tubercles or chitinous teeth. A minute dorsal one near the median line and two larger, widely separated teeth on the flattened area of the declivity. Between the larger tubercles and farther from the median line there are two minute chitinous points marking the real margin of the declivity. The prothorax is rather finely granulated and the wing covers are marked with longitudinal rows of rather fine punctures. The antennae are represented on plate 66, figure 5 and the middle tibia at figure 71*b*.

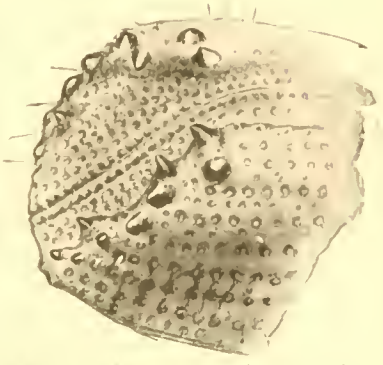


Fig. 72. Declivity of Tomicus caelatus (Eichhoff's illustration)

The galleries of this species, judging from the few specimens collected are more irregular than are those of some other members of the genus. The central or entrance chamber is well marked and from this three or more females may make their way in rather tortuous courses, sometimes parallel with and sometimes nearly across the bark fibers.

The eggs are deposited on both sides of the burrows and the grubs or larvae excavate very irregular galleries for a distance of about an inch and end their labors in a rather deep oval cell in the sapwood in which the grub transforms to the beetle.

Dr Fitch noticed this insect in his fourth report under the name of Tomicus xylographus Say and he comments as follows on the boring habits of this species. He states that a long slender cylindric gallery is formed which is excavated about equally in the outer surface of the wood and in the inner layers of the bark. In some cases two, three or even six galleries start from one point, running in opposite directions, but always lengthwise with the tree or limb. Little notches are excavated at intervals in the adult galleries while the work is in progress, one to four eggs being placed in each notch. The gnawings of the beetles are left

strewn in the bark behind them, and as they travel backward and forward in the burrow from time to time, the little stiff hairs with which their bodies are provided serve as a brush to sweep this dust into the egg notches. Thus the mouths of these chambers are filled and the eggs therein covered and concealed. The female forms a burrow from 4 to 8 inches or more in length.

Life history. Dr Fitch states that the eggs probably hatch in 10 to 20 days according to the temperature. The young grub is found lying with its back towards the sawdust with which the cavity in which the egg is laid was filled, it thus being close to the soft innermost layer of bark at the extremity of the notch. This cavity is continued by the larvae to a distance of from 1 to 3 inches at approximately right angles to the central gallery, which latter increases in size with the development of the grub. Those not overtaken by disaster excavate an oval cell in which the final transformation to the adult takes place. The small beetles escape from their retreats by boring directly to the surface of the bark.

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Southern tomicus

Tomicus cacographus Lec.

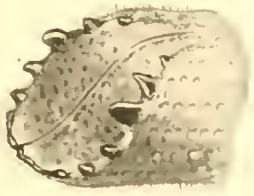
A small brown or blackish cylindric beetle about 1/8 inch long may frequently be found boring the thinner bark of smaller pines and that of the limbs of larger trees. It is usually associated in this work with one or more species belonging to this genus.

This bark borer is a medium sized form which was specially abundant in October 1900 at Manor L. I., where it attacked the hard pines which are so abundant in that region. This beetle prefers the thinner bark of smaller trees and also attacks the middle portion of the trunk and the limbs of larger pines. It is frequently associated in its destructive work with Tomicus calligraphus Germ.

This species was taken in August and September in considerable num-

bers at Slingerlands and Karner. It was found working in a recently cut hard pine at Karner and in white pine limbs which had just been cut at Slingerlands. This beetle was common at Manor L. I., in 1900. It was taken from under the bark of the middle portion of the trunk of a pitch pine, which was attacked at the base by Dendroctonus terebrans Oliv. It appeared to be the primary offender in one case where it was boring in large numbers in a limb on which the needles were still green, though they dropped readily. It was found working in the living tissues at the base of another dying hard pine. This lattter tree had thrown out sprouts in a last effort to sustain life and even these were dying. Another small tree was found badly infested with this bark borer. The leaves were just beginning to turn yellow and the attack was confined almost entirely to the upper portion of the trunk.

Description. This is one of the medium sized species of Tomicus. The beetle is a trifle over 1/8 inch long, cylindric, rather slender in form and like other species of this genus, varies in color from a light to a dark brown. The posterior excavation or declivity of the wing covers is bordered by a series of five teeth. The one near the dorsal median line is very minute, the second and third are much larger and connected at the base and the fourth and fifth are smaller and distinct from each other. The prothorax is rather coarsely granulated and the wing covers are marked with longitudinal rows of rather deep punctures. The antennal structure is illustrated on plate 66, figure 8 and the tibia in figure 7*a*.



The soft white pupae may be found in their oval cells in the bark. The pupa is usually creamy white, about as long as the beetle and with a tapering abdomen with one or two segments usually extending beyond the tips of the wing covers.

The full grown larvae or grubs are a creamy white, about 3/16 inch long and with the body slightly curved. The head is light brown with the tips of the mouth parts and adjacent sutures much darker.

Life history. Adults of this species were entering limbs in large numbers at Manor L. I. Oct. 3, 1900, the galleries evidently being both for hibernation and food. They were a little over 1/16 inch in diameter, exceedingly tortuous and apparently without plan. In one portion the beetles had just begun their operations and the curious manner in which they work in living bark is shown on plate 60, figure 1. A more advanced stage is illustrated at plate 60, figure 2, and this shows how completely a limb may be girdled within a short time. The specimen from which this illustration was made was taken from a limb about 10 feet long which bore many green needles. The foliage dropped readily and as the tree had apparently been vigorous till within a short time, the primary injury was attributed to this insect. A central or entrance chamber will be seen in both of these illustrations, though most of the galleries are very irregular. The tendency of the adults to work largely with the grain of the bark is shown in plate 60, figure 3, which illustrates a very badly eaten piece of hard pine bark. There was very little or no evidence of the operations of the larva in this instance. Dr Packard states that the burrows of this species are much like those of T. calligraphus Germ. except that the main gallery is narrower, being about 1/10 inch in diameter and the exit holes to correspond with the smaller size of the beetle.

So far as our observations go the galleries made by the beetles during the breeding period are more regular and are apt to run with the grain of the bark, the eggs being deposited on either side and the young making more or less oblique, serpentine galleries in the adjacent tissues. Later, the infested bark may become a mass of interlacing burrows partly filled with brown particles of decaying bark. A few of the adult galleries may remain comparatively untouched, but, as a rule, they are not so straight and sharply defined as are those of Tomicus calligraphus Germ. Dr Hopkins has observed that the beetles are attracted by turpentine.

Distribution. The distribution of this species has been given by Dr LeConte as the Southern and Western States and Dr Packard credits it with injuring the pines of North Carolina and southward even more than

T. pini Say in the north. Dr J. B. Smith records the insect as being present throughout New Jersey where it mines the green bark of dead or dying pines and spruces. Dr Hopkins states that it is very common in West Virginia under partly living, dying and dead bark of living, dying and dead standing and fallen pines and spruces. He states that it infests all of the pines and the native and introduced spruces and that it is widely distributed.

Natural enemies. Dr A. D. Hopkins has reared several parasites from this species. Spathius canadensis (?) Ashm. was bred by him from cocoons found in the mines of this insect in white pine and S. pallidus Ashm. was reared by him from cocoons occurring in the larval galleries under the bark of scrub pine. Hister parallelus Say and H. cylindricus Payk were taken by Dr Hopkins in the galleries of this species.

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Minute spruce bark beetle

Cryphturgus atomus Lec.

A minute, dark bark beetle about 1/10 inch in length, makes short sinuous mines in the bark of spruce and pine.

This is one of our smallest bark borers and in many instances is probably overlooked on this account. According to Dr Hopkins it enters the galleries of other bark beetles, from which it excavates numerous very small, irregular channels through the inner bark of dying and dead black and red spruce and white pine. The mine consists of a short, sinuous, primary gallery about 1/2 inch long from which arise on either side about 10 shorter secondary galleries. The beetles are sometimes extremely numerous, many mines occurring within a square inch of surface. Dr Packard records meeting larvae, pupae and beetles in great abundance at Brunswick

Me., in August 1880, where they occur in dead trees as well as spruce stumps, also in white pine stumps.

The following description of the beetle is given by Dr LeConte: Slender, dark, piceous, shining, prothorax distinctly longer than wide, sparsely and coarsely punctured; elytra very finely not densely pubescent, striae composed of shallow punctures, interspaces as well as the striae without distinct punctulations. Length, 1 mm +. Head with a broad short beak, slightly convex, finely not densely punctulate. Prothorax distinctly longer than wide, slightly rounded on the sides, gradually narrowed from the middle to the tip; disk transversely convex, not polished, but very imperceptibly granulate, sparsely and strongly punctured. Elytra cylindrical, not wider than the prothorax, convexly declivous behind; sparsely clothed with very short and fine yellowish pubescence, striae composed of rather large, shallow punctures, interspaces not narrower than the striae, almost imperceptibly punctulate. Beneath nearly smooth, sides of metasternum with a row of punctures, sides of ventral segments feebly punctured. Legs piceous, front tibiae with five distinct acute teeth on the outer edge, which is also sparsely fringed with long yellowish hairs, with a fine apical spine at inner angle; tarsi yellow, narrow, third joint not dilated. Antennae with the scape long, the first joint of the funicle large, rounded; second indistinct, closely connected with the club, which is large oval, not pointed, solid, polished and corneous, except along the apical margin, where there is a spongy sensitive band.

This species probably has a wide distribution in the northeastern United States, as it is recorded from Canada and Maine south to West Virginia and westward to Ohio.

Sawyer

Monohammus confusor Kirby

Large white, fleshy, legless grub from $1\frac{1}{2}$ to 2 inches long may frequently work in the inner bark and sapwood of dead and dying pines, spruces and balsams, and also in logs cut from these trees.

This species is one of the more common borers found under the bark of logs and dead and dying trees belonging to the species mentioned above. The presence of the borers in piles of logs may easily be detected by the masses of white sawdustlike borings which collect on the ground beneath or which may be found under the bark.

Injuries. Grubs belonging presumably to this species have been met

with by the writer in balsam, spruce, hard and white pines, and in not a few instances they were abundant enough to cause considerable injury and materially reduce the market value of the logs. This species, when numerous, also appears able to exist in living trees. The writer found a number of these grubs Oct. 16, 1901 at Bath-on-Hudson, working in living, apparently healthy bark and with the point of injury indicated by wormlike masses of pitch, showing conclusively that the grubs were operating in living tissues. The tree under observation was apparently not infested by any other insect and it appears probable that the beetles must have bred in large numbers in nearby decaying, dead or dying trees and then, because of the lack of more suitable conditions, attacked this living white pine. Another case was observed during the same summer where the grubs of this species were working in what appeared to be healthy pines and their operations were to be observed here and there over a considerable proportion of large trunks. It is remarkable how quickly this species infests a dying tree, and in not a few other cases have we been led to question whether the Monohammus larvae may not have followed the work of other species very closely, even if its attack was not coincident with theirs.

Early history. This species was noticed in some detail by Dr Fitch under the name of Monohammus notatus Drury. He characterizes it, M. marmoratus Rand. and M. scutellatus Say as the most common and pernicious borers of pine timber in New York. He states that felled pine timber allowed to remain in the forest through the summer months is likely to suffer much injury from these borers, and adds that they invariably make their exit from the wood on its upper side, and, as the holes from which they issue admit water, the timber decays rapidly.

This insect was noticed in 1877 by Rev. C. J. S. Bethune who states that it is very generally destructive throughout Canada and the Northern states, often being excessively abundant in pine regions. He cites Mr E. Billings to the effect that he once saw a pine tree near Lake Clear, Renfrew county, on which he calculated there were at least 300 individuals of this species, while many others were flying about in all directions. Dr James

Fletcher in 1887 includes this species and M. scutellatus Say as the two insects which probably commit the most serious ravages in Canada on felled pine timber or on standing pine trees after they have been injured by fire.

Description. The egg has been described by Dr Packard as follows: "Ovo-cylindrical, well rounded, but tapering somewhat at each end, of a dirty white color" and as about 1/6 inch long.

The grub is a white, fleshy, cylindric larva, which when full grown may attain a length of from 1½ to 2 inches. The mandibles are a very dark brown and the head varies in color from amber to rather dark brown, the deeper color occurring at the sutures. The thoracic shield is somewhat chitinized and bears a transverse, irregular, dark brown marking. This larva may be readily distinguished from that of Rhagium, which frequently occurs under similar conditions, by the entire absence of legs and by the head not being nearly so wide and flattened.

The adult insect is a magnificent grayish beetle, finely mottled with light brown and rather conspicuously dotted, specially on the wing covers, with dark brown or nearly black. The body length of the beetle varies from about ¾ to 1½ inches. The insect is remarkable for its enormous antennae, which may measure from 2 to 3 or more inches in length [pl.63, fig. 1].

Life history. The beetles are found in the vicinity of Albany from the latter part of June through July and into August and Dr Fletcher mentions taking an adult in September. This latter date is late for New York State. The beetles by preference frequent dying or dead trees and occasionally are found in considerable numbers.

The eggs of this species are deposited in conspicuous transverse gashes in the bark which are made by the female with her jaws. Dr Packard is of the opinion that the beetle prys up a portion of the gash and inserts the egg in the opening thus formed. The eggs are said to hatch in from two to three days after deposition and the young grubs at once begin boring in the inner bark. The earlier work of the larva or grub is confined almost

entirely to the inner bark, but as it increases in size the sapwood may be scored, and eventually the borer may go to some depth in the wood, particularly on the approach of winter.

This grub when near maturity is very strong and excavates large, irregular galleries in almost any direction in the wood, and has been frequently met with by the writer at the depth of 6 or 8 inches from the surface. He has seen small balsam trees, 6 inches in diameter, penetrated to the center by the grub, which subsequently completed its transformations and the beetle emerged on the opposite side. This borer works so vigorously that it may be heard at night gnawing in the wood.

The period required for the completion of the life cycle is unknown, though most writers are of the opinion that under ordinary circumstances three years are necessary. Dr James Fletcher calls attention to the finding of larva of all sizes in a pine which had been killed by fire the previous spring and from this he is inclined to believe that under certain conditions the life cycle may be completed in a year. It is known that this time may be enormously extended, since beetles have been bred out from wood which had been cut 10 to 15 or more years before.

Distribution. This insect, which appears to have a general distribution in pine, spruce and balsam regions, ranges from West Virginia into Canada and, according to published accounts, it appears to be much more abundant to the north.

Protective measures. Very little, or nothing can be done to protect standing trees from attack by this insect, other than the prompt cutting of dying and dead timber. Dr James Fletcher has pointed out that logs may be protected to a considerable extent by covering them with fir boughs so as to shade them from the sun. Probably any other shade would be nearly as effective. The removal of the bark would also aid materially in preventing the borers from entering the logs.

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White spotted sawyer

Monohammus scutellatus Say

This longicorn is much less abundant about Albany than its larger relative M. confusor Kirby. It measures about 5/8 inch in length and may be recognized by its nearly uniform black color mottled with white.

The writer took a specimen on dying white pine at Bath-on-Hudson July 26, 1901, and one on hard pine at Karner June 13 of the same year. It appears to be numerous in the Adirondack region, and somewhat so at Pike. According to Dr Packard it is common, sometimes abundant, in Maine and northern New England and specially in the lumber regions of Lake Superior, from whence he had received it in large numbers. It also occurs, according to him, in pine forests of British America, and in Washington and Oregon along the Pacific coast. Dr A. D. Hopkins records it as a common and destructive wood borer in dying and dead white pine in West Virginia. This species appears to be comparatively rare in New Jersey, since Dr Smith lists a single specimen from Newark and gives but one other locality where it is known to occur.

Rev. C. J. S. Bethune, writing of this insect in 1877, states that the species is sometimes very abundant in Canada, and that he has occasionally found the insects swarming in great numbers on fallen pines. Rev. Thomas W. Fyles records an instance where this species was extremely injurious to spruce in 1895. He states that in the spring one of his neighbors planted an extensive hedge around his grounds and by the end of the summer nearly every scion had been girdled or partially so by this beetle. He adds that in a heavy wind he has seen a large spruce tree snap off two feet from the ground, and on examination found that the stem was honey combed with the larval galleries of this insect. Dr James Fletcher states that shading cut logs with balsam boughs appears to be a very effective method of preventing injury by this species and M. confusor Kirby.

Tickler

Monohammus titillator Fabr.

A brownish mottled cylindric beetle, about ½ inch long, and with very long slender antennae, may be found in small numbers on pine trees in midsummer. The larvae bore in the wood.

This beautiful little beetle was met with in very small numbers in 1901 on both white pine and hard pine. This species is evidently widely distributed, since its range has been given by Dr Horn as from Canada to the state of Washington and southward. It occurs on pines in June and July throughout the state of New Jersey as recorded by Dr Smith. This insect was noticed briefly by Dr Harris, but he was not aware of its habits. Mr F. C. Bowditch has ascertained some interesting facts regarding it.

Life history and description. Mr Bowditch records taking adults under the bark of yellow pines in June, at which time a number were nearly ready to emerge, and a week later he discovered no less than 80 beetles in one tree in all stages of development, the largest being near the base. The larvae bore through the trunk, when it is less than 6 inches in diameter, instead of working here and there on the surface of the wood. He states that the larva feeds on the sapwood or inner bark till fall, when it turns and bores outward, leaving its passage filled with chips, and forms a hibernating cell about ½ to 1 $\frac{1}{10}$ inch beneath the bark, in which it completes its transformation during the winter or even as late as the last of June. The grub has been described by Mr Bowditch as follows:

The larva is a footless, yellowish, white grub, more or less hairy, cylindrical in shape, about 1 $\frac{4}{10}$ inches long, and $\frac{3}{20}$ of an inch in diameter. The body including the head is made up of 14 segments, the last eight of which have a kind of ridge on each side, covered with hairs longer than those which are found on the rest of the body and which doubtless assist it in locomotion, the second segment next the head is flattened on the upper side.

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Marbled sawyer

Monohammus marmoratus Rand.

This insect is much rarer in New York State than the larger M. confusor Kirby and the nearly equal sized M. scutellatus Say. The beetle is about 7/8 inch long and may be recognized by its light grayish wing covers mottled with brown and dark brown spots.

The insect was taken in small numbers the latter part of June and in early July, 1901 at Albany and a few specimens have been received by the writer from Pike.

It presumably has about the same habits as M. scutellatus Say. It was brought to the attention of Dr Fitch in 1857, who records the breeding of the beetle in July. Dr Packard states that it is not a particularly common insect.

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Ribbed pine borer

Rhagium lineatum Oliv.

A white, broad headed flattened grub frequently occurs in considerable numbers under the bark of dead pines, and transforms to a gray, black marked beetle with conspicuous ridges on its wing covers.

This species has been met with by the writer in considerable abundance under the bark of dead white or hard pines in the vicinity of Albany. It can not be considered injurious to living trees so far as our experience goes, since it is one of the forms which revels in partly rotten tissues, and the operations of the grub and associated insects soon loosen the bark so that it falls off in large sheets. This beetle was so abundant Sep. 2, 1901, under the bark of a good sized white pine, at Lansingburg, that about 25 adults, numerous pupae and larvae were obtained in a few minutes. Oct. 10 practically the same conditions obtained, though there may have been fewer larvae. It was taken Aug. 17, 1901, under spruce bark at Saranac Inn.

This species was noticed by Dr Rathvon in 1861, who found it very common in Pennsylvania and credited it with killing trees. It has been

recorded by Dr Packard as occurring under the bark of pitch pine and balsam trees. He found this species abundant under the bark of a white pine log at Salem Mass., in October, and states that he has frequently detected it in the same situations in Maine. He obtained both the larvae and adults Ap. 24. Dr Hopkins has recorded this species as mining under the bark of dying trees and states that it is common in Virginia. He records the presence of adults Ap. 8, May 5, 6, Oct. 17, Dec. 19, and pupa in October, and larvae July 14. He adds that it is a very common borer in decaying pine wherever the trees grow in West Virginia.

Description. This beetle is a grayish insect, mottled with black, about 5/8 inch long. Its general forms and markings are well shown on plate 64, figure 1. The prothoracic spines and the two prominent ridges on each wing cover are the most characteristic features of this beetle.

The pupa is white, rather stout, and varies in length from about 1/2 to nearly 3/4 inch. The dorsum of the head, meso- and metathorax and each abdominal segment bear minute hairs or setae somewhat grouped on each side of the dorsal line. The brown abdominal spiracles are conspicuous [pl. 64, fig. 4].

The pupal cell is constructed just under the bark. It is oval, about 1/2 by 3/4 inches in diameter and is partly lined with somewhat decayed wood particles. The most characteristic feature is the mass of fibers torn from the wood at the bottom of the cell and incorporated in its walls [pl. 64, fig. 7]. The excavation in the wood is probably necessary to give requisite depth for the thicker pupa and beetle. This is in marked contrast to the pupal cells of Pytho americanus Kirby, a species frequently associated with Rhagium and which is noticed on page 308.

The white flattened grub or larva ranges in length from 3/4 to 1 1/4 inches and is remarkable for its broad head which is amber colored and is fully as wide as the thoracic segments. The powerful jaws are tipped with black. The corneous prothoracic shield is yellowish, and the six true legs are poorly developed [pl. 64, fig. 11].

Life history. Some larvae, pupae and many beetles were found under

the bark of one tree Sep. 21, 1901. The remaining pupae were nearly ready to assume the adult form and the beetles were to be found mostly within the pupal cells. Many of them had begun to burrow in an oblique direction up and out through the bark. Some had just started the work but in many cases the beetles had nearly penetrated the thick bark, though none had escaped, so far as was observed.

The grubs of this species evidently become full grown during the latter part of the summer, construct their pupal cells, and transform to beetles before the approach of cold weather. The adults winter very largely in the pupal cells or in the characteristic upward curving exit burrows which they begin soon after assuming the adult condition.

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Pytho americanus Kirby

A small beetle with a black head and thin dark bluish green wing covers may be met with under decaying pine bark the latter part of the summer.

This species, like its associate, Rhagium lineatum Oliv., occurs rather commonly in moist decaying pine bark. The larvae, pupae and beetles of these two species may be found in large numbers under the bark of the same tree.

This insect appears to prefer the bark in an advanced state of decay and, like its associate, can be regarded as injurious only so far as it hastens the decay of dead trees, since it aids in loosening the bark and in exposing the wood to the elements. It has been recorded by Mr Harrington as occurring in Ontario, Can., in shallow cells under the bark of old logs and stumps. Dr Hopkins states that in West Virginia it commonly infests dying and dead bark in pine logs and stumps. He obtained adults in February.

Description. The beetle is much flattened and is about ½ inch long, with the head and thorax black, and the striated wing covers a dark bluish green. The powerful jaws are rufous, tipped with black, and the antennae, legs and abdomen are similiarly colored. The insect is represented on plate 64, figure 2.

The pupa is whitish, more slender than that of Rhagium, and may easily be recognized by its occurring in cells with walls composed entirely of nearly rotten particles of bark [pl. 64, fig. 3].

The pupal cell is nearly circular, about ¾ inch in diameter, and is constructed between the bark and the wood. There is no excavation in the wood and the walls are composed only of partly rotten borings [pl. 64, fig. 9]. The difference between the cells of Rhagium and Pytho is well brought out in the illustration.

Life history. The larva evidently becomes full grown the latter part of the season and transforms to the pupa and then to the beetle before the approach of cold weather. The species hibernates probably very largely in the pupal cells or under the bark.

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Spruce timber beetle

Xyloterus bivittatus Kirby

A rather stout, brownish black beetle, about ¼ inch long, attacks the exposed wood of various coniferous trees.

The deserted galleries of this species were found by the writer in a spruce log at Floodwood in 1901. This beetle was breeding Aug. 23 at Axton in a stump of a balsamtree which had been cut the preceding April. It has been recorded by Dr Hopkins as infesting black spruce and hemlock in West Virginia, and Dr Packard states that the insect occurred, though not commonly, under the bark of a fir in the White mountains near the

Glen House. Mr H. G. Hubbard states that this species is common in coniferous trees from Alaska to Maine and extending southward in the mountainous regions. He adds that it is equally common in northern Europe.

Description. This is a rather stout, brownish, black beetle, measuring but little over 1/8 inch in length. The form of the antennae, the sculpturing of the prothorax and the markings on the wing covers are well shown at figure 74.

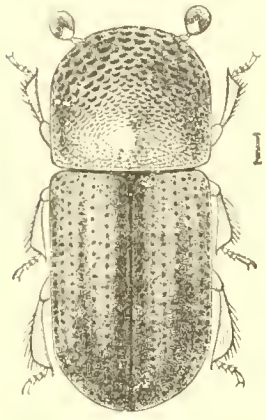


Fig. 74 Xyloterus bivittatus. (After Hubbard, U. S. Dep't Agric. Div. Ent. Bul. 7, n. s. 1897)

The galleries of this species, like those of the following, penetrate the wood vertically for some distance and then branch. The brood chambers are arranged at nearly equal distances and extend above and below in a direction parallel with the wood fibers. They are usually farther apart than in the case of X. politus Say. The walls are stained black as in allied species.

Natural enemies. Dr Hopkins has found Ips fasciatus Oliv. associated with this form in spruce logs, and larva, probably of the same species, in its burrows. A predaceous form, Thanerocleris sanguineus Say, was found by Dr Hopkins on a hemlock stump with this borer. He also records an interesting instance where large numbers of this species were taken in the stomachs of brook trout in Randolph W. Va. the latter part of May. The insects had evidently been flying in considerable numbers, dropped on the water and fallen a prey to the fish.

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Eastern pine wood stainer

Gnathotrichus materiarius Fitch

A brownish black, rather slender beetle about [illegible] inch long, enters the sapwood of dying and dead white pine, making cylindric galleries, the walls of which are stained black.

This common wood-boring Ambrosia beetle lives on a fungus cultivated in its galleries. This species is common in dying and dead white pines in different sections of the State, entering the wood very shortly after the tree has been injured as a rule. It was met with on spruce at Big Moose N. Y., July 2, 1903, it being attracted to trees injured by recent fires in that

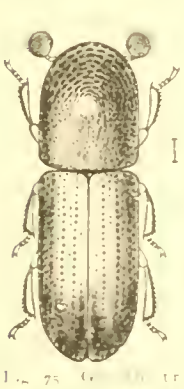


Fig. 75. [illegible] (After Hubbard and Hopkins, U. S. Dept. Agr., Div. Ent., Bul. 24, rev. ser.)

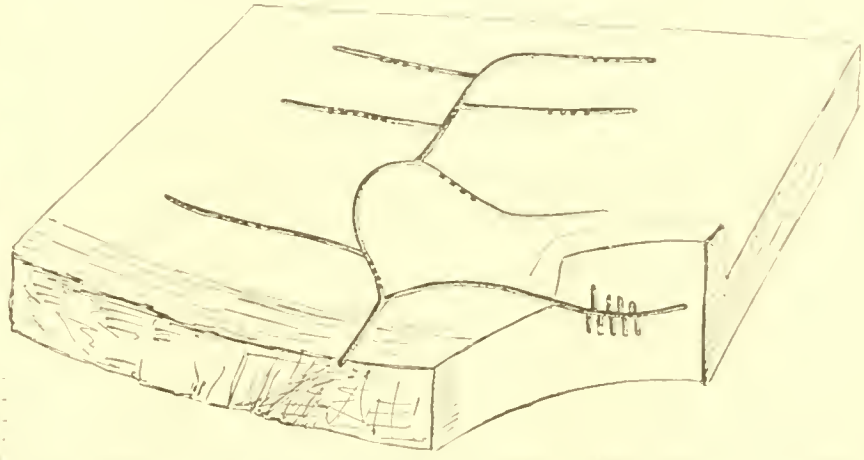


Fig. [illegible] Gallery of *Gnathotrichus materiarius* in pine. (After Hubbard and Hopkins, U. S. Dept. Agr., Div. Ent., Bul. 24, rev. ser.)

section. It has also been noticed by Dr Fitch. This insect makes slender, cylindric burrows across the wood fibers and usually parallel with the lines of growth. Short, straight, lateral galleries or brood cells branch off from the main ones at right angles above and below. This species is attracted by the odor of turpentine, and Dr Hopkins records it as one of a number collected on a recently painted greenhouse. He states that this species, associated with others, is frequently found in the sapwood of spruce at Williams River W. Va., and adds that it is very common in that state in the sapwood of dead and dying pine and spruce trees, logs and stumps. He

adds that it is widely distributed. A small beetle, Hister parallelus Say occurs in the burrows of this insect and may possibly prey on it. The presence of this borer, as well as that of some others, may frequently be detected by the small piles of white sawdust on the bark or at the base of infested trees.

Description. This beetle is a rather slender, cylindric, brownish black insect, about 1/8 inch long, and with yellowish legs. The globular antennal club, the puncturing of the thorax, and the linear dotting of the wing covers are well shown in figure 75. The structure of the antennae is represented on plate 67, figure 4, and that of the middle tibia at figure 78*a*.

The burrows of this beetle extend into the wood vertically for a short distance, in a specimen at hand less than 1/2 an inch. This main gallery has several branches diverging in a direction approximately parallel with the lines of growth, each of which leads into a series of vertical brood chambers. The illustration is typical of the complex system of galleries.

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Pityophthorus sp.

An insect belonging to this genus was met with by the writer Aug. 22, 1900, at Axton, where it was working in small numbers under the bark of a young dying white pine. The central chamber of this species is somewhat circular and in the specimen figured has four primary galleries with a short fifth. The primary or egg galleries run longitudinally or obliquely to the wood fibers and cut into the wood a considerable proportion of their depth. The larval galleries are somewhat tortuous, expand very gradually, and also cut the sapwood for about 1/2 their depth, and toward the extremities a greater proportion lies in the wood [fig. 77].

Pityophthorus sp.

A small species belonging to this genus was met with by the writer Sep. 8, 1900 at Karner, working under the bark of a dead hard pine limb.

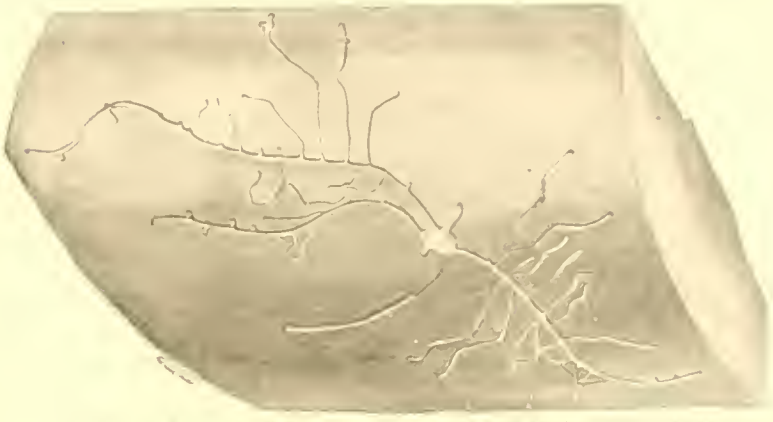


Fig. 67. Work of Pityophthorus sp. — small bark beetles — (original).

Recently transformed adults and a few pupae were observed in the galleries. The twig was also bored by a longicorn larva. The adult galleries of this insect are remarkable for their delicacy. They are well represented in plate 63, figure 6. It will be seen that the general design has been much marred by the work of the longicorn above mentioned, and the tortuous larval galleries may be seen branching from the primary ones at irregular and somewhat considerable distances. The larva as it attains maturity appears to make a very irregular excavation which sometimes doubles back on itself or is simply a very broad excavation.



Pityophthorus sp.

This species was taken Sep. 8, 1900 at Karner from dead limbs of pitch pine. Its breeding season was evidently nearly at end as a very few pupae and some recently transformed adults were found.

Description. This is a reddish brown or almost black, rather slender, cylindric beetle measuring but little over $\frac{1}{16}$ inch in length.

The adult burrows, in the smaller limbs just beneath the bark, are usually nearly parallel with the grain of the wood and may extend a distance of 3 or more inches. The irregular, serpentine burrows of the young are $\frac{1}{4}$ inch or more apart, over $\frac{1}{2}$ inch long and usually alternating on each side of the parental gallery.



Fig. 79. Work of Pityogenes sp. a in white pine (original)

Pityogenes sp. a

Another species of this genus, stated by Dr Hopkins to be a new form, was met with by the writer at Saranac Inn in August 1900. It was working in a nearly dead young pine and its galleries are quite different from the following. The central chamber is not quite so large, the egg notches appear to be placed closer together, and the larval galleries do not groove the wood so deeply as a rule. The pupal cells are sunken much more deeply into the sapwood. Figure 79 illustrates the work of this species. Apparently the same insect was met with in another white pine where it was associated with Tomicus caelatus Lec., and also in balsam, where it occurred in company with the last named species and Tomicus balsameus Lec. This latter tree was dying and had been abundantly infested by the bark borers.

Pityogenes sp. b

A small beetle, a little over $\frac{1}{12}$ inch in length, works in the bark of dead white pine limbs. The prothorax is dark brown, rather coarsely tuberculate, while the wing covers are a lighter brown, nearly smooth, and with two or three minute tubercles on the declivity of each.

This species was met with by the writer Aug. 5, 1900, at Slingerlands N. Y., where it was working on pine limbs which had evidently been recently cut. Larvae and pupae were present and the insect had begun operations only a little while before. Tomicus cacographus Lec. was associated with this borer and also a species of Hypophloeus. This

bark borer occurred in the limbs of a dying white pine at Saranac Inn, Aug. 19. All stages were present and though the tree was not excessively infested, it may possibly have had a hand in its death, as its burrows were found along the entire length of the tree. It was associated with Tomicus balsameus Lec., another species of Pityogenes, Hypophloeus and a Chalcid. The two latter were not determined.

This insect was also met with Sep. 18, 1909, at Bath-on-Hudson, where it was boring the dead limbs of white pine in which were found larvae, pupae and adults. This tree had also been attacked by Tomicus calligraphus Germ. The borings of this species form a rather large irregular central chamber with 3 to 4 or 5 primary or egg galleries diverging, sometimes obliquely and sometimes at right angles to the wood fibers. In one case noticed, several larval galleries originated from the central chamber, showing that the eggs in at least one instance, were deposited in little notches in its wall. The primary or egg galleries are from about 1 to 1½ inches in length, and from them arise the slender, somewhat tortuous larval galleries, which latter may attain a length of about 1½ inches [pl. 63, fig. 5]. Pupation occurs at the tip of the mine in a slightly enlarged cell which is sometimes excavated in the sapwood. The beetles emerge therefrom through vertical exit holes.

Balsam bark borer

Tomicus balsameus Lec.

Balsam trees with red tops may frequently be observed in the Adirondack region and a close examination may show that a small brownish or nearly black beetle about ⅛ inch in length is working in large numbers in the inner bark.

The balsam is one of the handsomest trees in the Adirondack region and forms a very characteristic feature of the landscape. It is not a specially valuable tree but as a subject of insect attack, it is of interest. Many healthy balsamtrees have probably been killed by this borer though it also works in diseased or sickly trees and hastens their death by its operations. Affected balsams may easily be detected at a distance by their reddened tops though this sign does not invariably indicate the presence of borers.

This species appears to be quite prevalent in the Adirondacks, judging both from observations and reports and as it frequently concentrates its attack on one or two trees, the inner bark is soon repeatedly traversed with interlacing burrows of beetles and grubs.

This species appears to exist wherever its favorite tree, the balsam, grows, though it does not hesitate to attack spruce and white pine. It has been found in the Adirondacks in both of these latter trees several times, once in arbor vitae, and it has been reared from hemlock. There is little doubt of this insect's ability to kill healthy trees. A balsam 10 inches in diameter just beginning to die, as was shown by its reddening top, was cut down Aug. 14, 1900. This borer was found in all stages and in large numbers from the base of the tree almost to its tip, some 50 feet high. The bark along much of this distance appeared to be healthy and the lower limbs had not begun to show any signs of weakness. No other insect had affected the vitality of this tree, so far as could be determined. Such balsams were to be met with here and there in the woods and it was stated that many of these trees had been affected in this way a few years earlier. Numerous dead balsams here and there, attested the truth of this assertion.

This insect was associated with Tomicus pini Say and species of Pityogenes, in white pine. It was obtained with Cryphalus striatulatus Mann. and also with Polygraphus rufipennis Kirby from spruce. Tomicus caelatus Eich. was found with it in balsam. It was taken by the writer at Floodwood, at many places about Saranac Inn, at Axton and vicinity and at Ampersand pond.

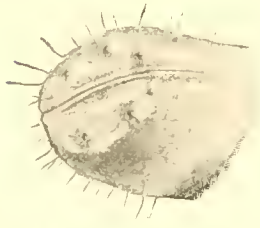


Fig. [illegible] Declivity of Tomicus balsameus (author's illustration)

Description. This is our smallest species of Tomicus, the adult beetle being only about 3/32 inch long. It is rather slender in form and varies in color from light brown to almost black. The rather coarse, light brown hairs are quite conspicuous near the posterior end of the elytra and the possession of these enables one to separate it from the allied

species. The excavation of the declivity is comparatively slight and is marked on each side by the three small independent, nearly equidistant tubercles, the lower two being larger and farther apart. There is also a very minute tubercle a little above and outside of the lowest tubercle but ordinarily it is not seen. The dorsal tubercle of the three is small and near the median line. The prothorax is coarsely granulated and the wing covers are marked with longitudinal rows of rather small punctures. The general form and structure of the antennae and tibia are shown on plate 66, figure 1 and at figure 90a.

The white pupa of this species is about the same size as the beetle.





It tapers somewhat at the posterior extremity, which latter bears a pair of slender pointed processes.

The partly curled grub or larva is almost ⅛ inch long and has a brownish yellow head with dark mouth parts.

Habits. The operations of this species are best seen in a tree which the beetles have just entered. There will usually be found three to five branch burrows here and there under the bark. A very small one is shown on plate 62, and in figure 81. It will be seen that there are five radiating

adult galleries and that each one contains a number of minute notches, the egg chambers. Each branch represents the work of a female and all have origin in a central chamber near the entrance of which the male stands guard.

A more advanced stage of this insect's work is shown at plate 62, figure 3, which represents the work of three females diverging from a common chamber. It will be seen that a number of the eggs have hatched and that the larvae have worked to a considerable distance in a direction nearly par-



Fig. 83 Split twig showing girdling by adult galleries of Tomicus balsameus (author's illustration)



Fig. 84 Galleries of Tomicus balsameus showing pitch chamber, pupal cell in sapwood and work of young Monochammus larva (author's illustration)

allel with the wood fibers. The egg notches are also visible. The same gallery as it appears on the bark is represented at plate 62, figure 1. It will be seen that in this instance at least, the larvae bored in the sapwood rather more than in the bark. A still more advanced stage is shown at plate 62, figure 5, which represents a portion of a trunk which had been injured by a large number of the beetles. The adult galleries, egg notches and the work of larvae or grubs can all be seen.

Plate 62, figure 4, represents a portion of a very badly infested trunk

after the attack has practically ended. It will be observed that the inner bark is a mass of partially decayed tissues tunnelled by numerous larval and adult galleries. Figures 82, 84 represent the condition after the decayed tissues have been removed. The adult galleries may be easily recognized where they score the surface of the wood and here and there are peculiar chambers a little to one side of an adult gallery. These are not central or entrance chambers but are evidently little cavities hollowed out by the beetles for the reception of balsam and show conclusively that the tree must have been alive at the time of the initial attack. The hard, dried balsam can easily be found in such cavities.

Figure 83 illustrates very nicely how thoroughly this insect may girdle twigs. It represents a small twig less than ½ inch in diameter and shows the adult galleries of two females passing from a central chamber around the twig in opposite directions and overlapping each other on the farther side by about ½ inch.

The larvae or grubs pursue a rather tortuous course at approximately right angles to the parental galleries and end their operations in a slightly enlarged elliptic cell where the final transformations to the beetle occur.

Natural enemies. The writer collected two parasites, Spathius tomici Ashm., and Cosmophorus hopkinsii Ashm. in the burrows of this bark borer.

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Spruce destroying beetle

Dendroctonus piceaperda Hopk.

A rather stout, brownish or black beetle about ⅛ inch long, makes longitudinal galleries in the inner bark and outer sapwood of living spruce. These, in connection with the more or less transverse expanding larval galleries, frequently result in the destruction of trees.

This species, though only recently characterized, is an exceedingly destructive form, and its ravages have been known for some years, though the operations were usually attributed to another species.

Early history. Dr Hopkins states that there is a record of this insect killing spruce in the neighborhood of Sherburne Vt., in 1831 to 1833, and in 1840, according to Henry Hough, there was serious injury to spruce in Newport, Sullivan co., N. H., probably by the same species. Prof. C. H. Peck, state botanist, when investigating the work of this insect in the Adirondacks in 1874, learned that the greatest destruction of spruce in Lewis county occurred 10 or 15 years before. The same trouble, according to him, was experienced in Rensselaer county about 1854. "A lumber firm found that their spruce timber was rapidly dying, and to make their loss as light as possible, they made haste to open roads in the forest that they might draw out and work up as many dead spruces as practicable before decay should render them entirely worthless, but with all their promptness they suffered no inconsiderable loss, for these dead trees soon became too much decayed to make marketable lumber."

Professor Peck's investigations are of exceptional interest, particularly as we have been fortunate enough to examine specimens collected by him at that time, and therefore can be certain regarding the identity of this insect. A portion of his observations for the year 1874, follow:

In August a collecting trip was undertaken in the vicinity of Lake Pleasant, Hamilton county. While there it became apparent to me that I was in a region where the spruces were dying. Standing near the outlet of the lake and looking upon the distant mountain slopes toward the northeast, east and south, patches of brown appeared here and there mingled with the usual dark green hue of the forest. The inhabitants told me that these brown patches were groups of dead spruces; that the spruce trees were then rapidly dying, and had been for two or three years previous, and that in consequence the value of the woodland was greatly diminishing. One of the most conspicuous of these brown patches was on the slope of Speculator mountain, a little more than half way from the base to the summit. Preparations were therefore made to visit this locality. Once on the ground it needed but little observation to satisfy me that the destructive process was then in operation. The ground under some of the spruces was thickly strewn with their fallen leaves, yet green, and every agitating wind was bringing down more of them. The bark of these trees, and of others already dead, was perforated in many places with small round holes scarcely $\frac{1}{8}$ of an inch in diameter. Upon stripping a piece of bark from the trunk of one of the affected trees, the apparent cause of the mischief was at once

revealed. The surface of the wood and the inner layers of the bark were abundantly furrowed by the winding and branching galleries of a small bark-mining beetle. . .

Small trees are rarely attacked. In the localities visited, from one half to two thirds of the spruces with a basal diameter ranging from one to two feet, were either dead or dying. Trees of this size are the most suitable for lumber and consequently the most valuable. The smallest affected tree noticed, had an estimated basal diameter of about 10 inches. In this case the attack appeared to be a failure, for so much resin had oozed from the wound that the work was obstructed. The galleries were scattered and single and their authors were found dead, each in its furrow. . . When two trees of unequal size stand in close proximity the larger one seems to be most liable to be attacked. In one instance two trees stood scarcely more than three feet apart. The larger one had been attacked; the smaller one remained unharmed. In another similar instance the larger of the two trees was dead, having been attacked first; the other was dying.

Professor Peck's observations in 1876, are also given in part as follows:

The green slopes of Mt Emmons, commonly called Blue Mountain, and of several mountains to the north of it had their beauty, and their value too, greatly impaired by the abundant intermixture of the brown tops of dead spruces. The destruction was also visible along the road between Newcomb and Long Lake, and on the mountain slopes farther to the north of this road. Again, on the trail from Adirondack to Calamity pond, there was sad evidence that the little destroyer had invaded also the forests of Essex county. From what I have seen at Lake Pleasant, in the southern part, and in the vicinity of Long Lake, in the northern part, and from information concerning the Cedar river region, in the central part of Hamilton county, there is reason to believe that much of the spruce timber of this country has already been invaded by the beetle. How much farther this destructive work has extended, or will extend, it is impossible to say. But one thing is certain, it is still in progress.

There are other records of extensive injuries to spruce, presumably by this species, about this time. Dr Packard reports serious damage about Beede's hotel, Keene Flats in the Adirondacks, where the spruces had been dying for about 15 years. Serious injury was caused in Maine between 1874 to 1881, extensive damage occurred about this time on the Allegash and other tributaries of the St John river, and dying spruce was met with in northern New Hampshire by Fiske in 1897. The damage caused by

this species has been estimated by various correspondents at 10, 50 and even as much as 90%.

Description. The parent beetle is a small, rather thick, light or dark brown insect about 3/16 inch in length. It presents no distinctive character which will enable its separation from allies, and it is more easily identified by its work, as no other insect of its size causes so much injury to spruce. The middle tibia is illustrated at figure 85*b*.



Fig. 85. Middle tibiae; *a*—Polygraphus rufipennis; *b*—Dendroctonus piceaperda (original)

Its attack is limited, as observed by Professor Peck, mostly to the larger trees, it rarely being found in those less than 10 inches in diameter. The most characteristic feature of injury is the browned tops, and an examination of the trunk usually results in finding tubes of pitch, which are pushed out from the wounds made by the beetles when excavating an entrance. The adult galleries are about 1/8 inch in diameter and run longitudinally for a distance of several inches, eggs being laid on either side and the larvae working more or less obliquely and very irregularly from this central gallery [pl. 61, fig. 1]. Their burrows are easily recognized by their irregular, more or less tortuous course and expanding character. Adult galleries preserved by infiltrated pitch are shown at plate 61, figure 2. These illustrations are specially valuable as they represent material taken by Professor Peck some 30 years ago.

The following more detailed account of this insect's work by Professor Peck, will also prove of service.

For the purpose of gaining more knowledge of the insect, I cut down at South Pond, a tree that had recently been attacked by it. It was about 20 inches in diameter at the base; the foliage was still fresh and green, and there was nothing, except the perforations in the bark, to indicate that it was at all affected. The bark peeled from the trunk without much difficulty, the sapwood was perfectly sound, and the heartwood also, except a small portion in which there was a slight appearance of incipient decay. Longitudinal furrows, varying from one to six inches in length, were found

under the bark, and each furrow was occupied by one or two beetles. The furrows are excavated from below upwards. In the short ones but one beetle was found, and but one perforation communicating with the external air. In the longer ones two beetles (probably the two sexes), were usually found, and from two to four perforations afforded means of ingress and egress. The lowest perforation, which is the one by which the beetle first enters and commences its furrow, is often found closed or "blocked up" by the dust and debris thrown down by the excavator in the progress of the work. The second perforation is generally one or two inches above the first. I failed to discover whether it is made by the second beetle for the purpose of ingress or by the first beetle. The third and fourth perforations are in a nearly direct line above the other two and are probably made from within outwardly, but for what purpose is uncertain. In one instance the two beetles were found at work making these perforations, boring through from the inner surface of the bark. In one instance the third was less than half an inch above the second, so that there would seem to be no particular necessity for it. The eggs of the insect are deposited along both sides of the upper part of the furrow. They lie close together, almost or quite in contact with each other. When the larvae emerge from the eggs they begin to feed upon the soft cambium and to work their way under the bark at right angles to the main furrow. They are, at first, so minute and work so close together that they make no distinct furrows but seem rather to devour entirely a very thin layer of the cambium. But as they increase in size they begin gradually to form distinct furrows and to take directions more divergent from each other and from their original course. In this way colonies from contiguous furrows at length run together and in time the whole trunk is surrounded by their multitudinous pathways, and the death of the tree is accomplished. Great care is taken by the parent beetles to keep their furrows separate. No instance was observed in which they ran together. In one instance the course of a furrow was changed to avoid running into the lateral furrows of a colony of larvae just above. No furrows were found in the tree more than 10 or 12 feet from its base, thus indicating that the attacks are made upon the lower part of the trunk. The attacks are not made simultaneously. Some of the furrows in this tree were scarcely more than an inch long, and evidently had been just commenced. Others were fully excavated and contained eggs, and in others still the larvae had hatched and commenced their work, but in none were they fully grown. In another tree, a few rods distant from the first, the attack had evidently been made earlier in the season, for the larvae were farther advanced in size and the bark, on one side of the tree was well loosened, though, strange to say, the other side of the trunk was comparatively unharmed. I was unable to discover why in this instance, the attack was limited to one side of the trunk. It is pretty evident therefore that the trees are attacked all along during the months of June and July and possibly as late as August.

Life history. The life history of this species has been carefully studied by Dr Hopkins, and the following is his summary:

These observations would also indicate that activity ceases in the fall by about the middle of October, when all stages of the insect may occur in the bark of infested trees where they, with the probable exception of the eggs and pupae, remain until the first week in June. Activity then commences, the mature larvae change to pupae, and by the middle of June those that pass the winter in the adult stage emerge and commence to excavate galleries and deposit eggs. The adults from the hibernating larvae of different stages, develop and continue to emerge possibly until the last of August. Therefore the eggs deposited by the late developing beetles produce larvae which do not complete their development until July or August of the next year. Thus, the period of development may vary from about 70 days to about 12 months, but all broods from eggs to matured and emerging adults remain in the bark about 12 months, of which they are dormant about seven and a half and active four and a half.

Natural enemies. This species is subject to attack by several natural enemies. The commonest parasite, according to Dr Hopkins, is Bracon simplex Cress., a well known species which lives at the expense of a number of wood borers. The antlike clerid beetle, Thanasimus nubilus Kl., is said by Dr Hopkins to be a very efficient enemy of this species. He states that the adult emerges from the bark of infested trees somewhat earlier than the spruce destroying beetle and remains hidden thereon till the bark borers commence to emerge, when it pounces on and devours them. It also follows the beetles to other trees and continues to prey on them, and while it does not enter the galleries, it deposits eggs at their entrances, so that the active reddish larvae hatching therefrom can readily enter and feed on the bark beetle larvae. The clerid larvae on attaining full growth retire to the central Dendroctonus galleries, pupate and transform to the adults.

Woodpeckers are valuable checks on this species. Professor Peck states that many of the dead trees in two groves observed by him, had their bark so chipped by woodpeckers, that the general hue of the trunk was a reddish brown instead of the usual greenish brown. Dr Hopkins states that he is quite confident that in many hundreds of infested trees examined, at least one half of the beetles and their young had been

destroyed by birds, and in many cases a greater proportion had perished from this cause. He states that the arctic three-toed and banded three-toed woodpeckers render by far the greater service and probably do their principal feeding during winter on this bark borer.

Remedial measures. Dr Hopkins advises regulating winter cutting of trees so as to include as many of the infested, dying and dead ones as possible and then placing the logs from the same in water before the first of June. He also advises arranging the summer cutting so that as many recently attacked trees as possible may be cut and the bark removed from their trunks and stumps. He suggests, in badly infested areas where logging operations will or can be conducted the following summer and winter, girdling a large number of trees early in June. These girdled trees are for the purpose of attracting the borers, and if felled later and either peeled or placed in the water before the first of the succeeding June, a large proportion of the insects will be destroyed. His experiments in girdling indicate that the best time for this is when the flowers (catkins) are falling from the birch, and while the flowering or bird cherry and the hobblebush are in bloom. The girdled trees should be sound and healthy and not less than 15 inches in diameter. The best method of girdling seems to be hacking through the bark with an axe into the sapwood and around the trunk two or three feet above the base.

The dead spruce remains sound for some time and is valuable for pulp wood at least, for a considerable period. It should be cut and utilized as rapidly as possible, and the same is true of mature living timber in sections where the beetle is at all abundant.

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Spruce bark beetle

Polygraphus rufipennis Kirby

A light brown or black, rather stout beetle about 1/3 inch in length makes somewhat irregular transverse galleries, from which diverge smaller dilating larval galleries, in the inner bark of spruce.

This very common species in the Adirondacks is a dangerous enemy of the spruce. It can usually be found in small numbers in this tree and it is frequently present in great abundance in the bark of cut logs or trimmings. This bark borer was taken by the writer in 1900 in several localities in the Adirondacks. It was found Aug. 14, 1900, in all stages in the bark of cut spruce logs and some nearby fallen spruce were badly infested by the insect. It was present Aug. 22 at Axton, breeding in large numbers in logs cut sometime during the preceding month. Old beetles were scarce at this time and there were numerous larvae and few pupae, indicating that the infestation was a comparatively recent one. This insect was also found at work in considerable numbers in spruce tops cut between September and December of the preceding year, and remains of this species were found under the bark of dead spruces standing on the edge of Little Clear pond at Saranac Inn. Large numbers of trees had been affected in in this manner and the primary cause of the trouble in this particular instance was probably the raising of the level of the pond, which had occurred several years earlier. This borer was found by the writer associated with species of Dryocoetes in spruce and with Tomicus balsameus Lec. in balsam, and Dr Hopkins records finding a single example in pine.

Early history. Very little has apparently been recorded concerning this borer aside from the facts made known by Dr A. D. Hopkins who has made an exhaustive study of this insect in West Virginia, and writing of it in 1893, states that it infests black spruce. His studies led him to believe that it was a very dangerous enemy of this tree and that it may have been the species to blame for the great destruction of spruce timber in West Virginia in 1883 to 1885.

Description. The beetle varies from a light brown to a black. It is quite small, being about $^{3}/_{32}$ inch long and with a rather stout form. The head is thickly and finely punctured and nearly concealed by the overhanging prothorax. The mouth parts are tipped with black and the concolorous, coarsely granulated eyes are divided, the two portions being connected by a smooth strip of chitin. The prothorax is much narrowed in front, thickly and finely punctured and the wing covers or elytra are rough, finely punctured and almost striate. The structure of the antennae is shown on plate 67, figure 8, and that of the tibia in figure 85*a*.

The white pupa is about the same size as the beetle, rather stout and with a tapering abdomen terminated by a pair of fleshy spinelike processes.

The brown headed, white grubs or larvae are about $^{1}/_{4}$ inch long when full grown. The mouth parts and adjacent sutures are a dark brown and the body is usually somewhat curved.

Life history. The life history of this borer in West Virginia has been given by Dr Hopkins as follows:

The adults emerge in May or June and are attracted to stumps, trunks and tops of recently fallen trees and those that are weakened by the attack of insects, such as the destructive pine bark beetle, Dendroctonus frontalis Zimm., or diseases of any kinds. The beetles commence to excavate entrance galleries through the outer bark, and their presence is indicated by the fine brownish borings in the crevices of the bark. This entrance is extended to the outer surface of the inner soft bark where the central chamber is excavated. In the meantime, the female, which appears to do the greater part of the work, is joined by a male who stations himself in the outer gallery to keep out enemies and objectionable visitors and to render assistance in expelling the borings. The female excavates a gallery from one edge of the central chamber through the inner bark of the wood and then in the inner layer of the bark, usually at right angles to the bark fibers, and for a distance of one or two inches. Small notches are made along the sides of the brood gallery, in each of which pearly white eggs are deposited. One to three other females are admitted to this central chamber by the male and from it extend similar



Fig. 8. Pityophthorus pubescens, entry galleries and egg notches (from Hopkins)

galleries in other directions from the central chamber. The eggs begin to hatch before the galleries are finished and the grubs burrow in the inner bark on which they feed. The surrounding bark is filled with grubs of various sizes by the time all the eggs are hatched and soon all of the inner part, for a radius of from 2 to 4 inches, is completely honeycombed with burrows. The male guards the entrance in the meantime, and the females either rest in the central chamber or egg gallery, or emerge to make an entrance to the bark in another place and start a new brood. The larvae on attaining their growth enlarge the end of their burrow to form a cell in which they change to the pupa, thence to the adult, and then either

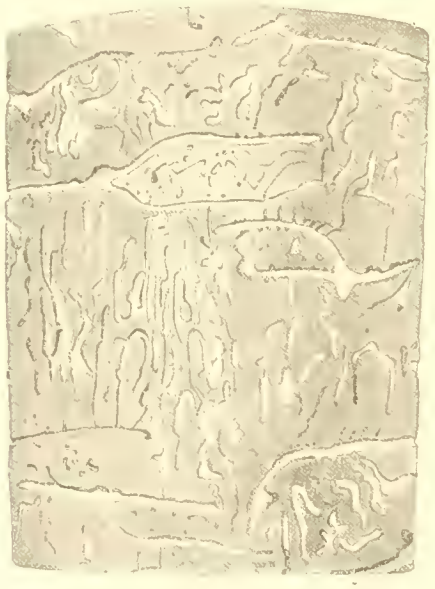


Fig. 87 Spruce bark rather badly eaten by Polygraphus rufipennis (author's illustration)



Fig. 88 Spruce bark badly eaten by Polygraphus rufipennis (author's illustration)

emerge from the bark and start a second brood or remain in this retreat till the following spring.

Dr Hopkins states that two or three broods may occur in one season and that his observations have lead him to believe that owing to the shortness of the season in the high elevations occupied by the spruce in his State there is generally only one generation. This species, as well as some of its allies, occasionally occurs in swarms since Mrs Slosson records hundreds of them in the air at Mt Washington in 1895.

The galleries of this insect are very characteristic and may be distinguished from those of Tomicus balsameus Lec. which works in balsam, and may therefore be met with in the same forest, by the fact that the wood is rarely scored by the galleries of the spruce infesting species, while the balsam borer frequently cuts nearly half of the diameter of the primary gallery from the sapwood. The general character of these galleries is well shown in the accompanying illustration which represents the central chamber, the transverse primary or egg galleries diverging therefrom, together with a number of small dilating mines of the young. It will be observed that the larval mines begin as very slender borings which widen gradually and end in a somewhat broader pupal cell which is sometimes excavated partly in the sapwood. Several of the egg chambers may also be seen.

Distribution. Dr Hopkins states that this species is evidently widely distributed over North America and doubtless occurs where its food tree is indigenous. It has been recorded from New Hampshire to Alaska, and Georgia, and in West Virginia it appears to be confined to the Canadian life zone of the spruce area, since it has never been met with in cultivated spruce or in other life zones.

Associated insects. Dr Hopkins records having found the following species associated with this insect in spruce: Homalota species, Baptolinus longiceps Fabr., Paromalus bistriatus Er., P. difficilis Horn, Epuraea truncatella Mann., Hypophloeus parallelus Melsh. and H. thoracicus Melsh. and a Tenebrionid larva. He also obtained a Dipterous larvae from the galleries of this borer.

Natural enemies. The following predaceous insects were observed by Dr Hopkins either in association with this borer or preying on it: Thanasimus trifasciatus Say, T. dubius Fabr., Phyllobaenus dislocatus Say, and a Clerid larva.

The following parasites were reared by Dr Hopkins from this species or collected by him from infested logs or trees: Spathius claripennis Ashm., Caenophanes pityophthori Ashm., Cosmo-

phorus hopkinsii Ashm., a common parasite of the adult, a species of Eurytoma, a species of Lochites, Cecidostiba polygraphi Ashm., C. dendroctoni Ashm., Decatomidea polygraphi Ashm. The value of these insects in controlling this borer is shown by the fact that Dr Hopkins believes them to be the principal natural agents in checking the injuries to spruce in West Virginia between the years 1882–1889.

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Spotted buprestid

Melanophila fulvoguttata Harr.

Flattened, white or yellowish spotted beetles about 3/8 inch in length, occur on spruce and hemlock in July, and are the parents of an injurious flat-headed borer.

This destructive beetle is sometimes very abundant in hemlock and spruce. Specimens were taken on hemlock at Big Moose, July 6, 1903, and a larva, probably belonging to this species, was met with under somewhat moist spruce bark at Saranac Inn, Aug. 17, 1900.



Fig. 59 Melanophila fulvoguttata, enlarged (original)

Description. The beetle is about 3/8 inch long, of a dark metallic color with greenish reflections above the mouth. The head, thorax and wing covers are marked with somewhat coarse, irregular, transverse punctures, slightly resembling the graining of morocco leather. Each wing cover bears three nearly circular or lenticular shaped yellowish or white spots. The larva is of the ordinary buprestid shape with a wide, flattened head.

Life history and habits. Dr Harris records taking this insect from the trunks of white pine in June, and Dr Hopkins states that in West Virginia

it infests green bark on living injured and dying hemlocks, the beetles occurring the latter part of March and during May, June and July. He also adds that it has caused the death of a great number of hemlock trees in that State. Dr J. B. Smith records this insect on both spruce and hemlock in New Jersey.

Distribution. This species occurs throughout the middle and northern part of the United States, being very abundant about Lake Superior, according to Dr LeConte. It has been taken by Mrs Slosson on Mount Washington, and occurs in limited numbers in southwestern Pennsylvania.

Natural enemies. A single parasite, Bracon pectinator Say, was bred by Messrs Riley and Howard from cocoons found in the larval mines of this insect.

Red cedar bark beetle

Phlocosinus dentatus Say

A light brown or black beetle, about 1/16 inch long, makes peculiar clubbed, longitudinal galleries under the bark of red cedars.

This little beetle can hardly be classed as injurious in the Adirondacks, since it was found by the writer in comparatively small numbers only in dying or dead limbs. It was taken by him Aug. 21, 1900, at Floodwood, from limbs cut the preceding June, as nearly as could be ascertained. The beetles were just beginning their operations at this time.

This insect was also found in small numbers in the dying red cedars at Axton. It is evidently a common species in northern New York, because almost all red cedar used in the construction of rustic summerhouses and similar structures is very prettily grooved by the characteristic burrows of this insect.

Early history. Dr Packard states that this is a common species on junipers about the city of Providence R. I., where its attacks are confined to sickly or dead trees. The beetles were found alive in their burrows May 12 and 13, and also nearly full grown larvae but no pupae. He has found this insect in considerable numbers in northern Maine under the

bark of cedar, Thuja occidentalis. He states that Mr Knaus considered this borer very destructive to junipers and arbor vitae in that State. It was first noticed at Salina Kan., in the summer and fall of 1884, attacking the junipers on the grounds of many residents of that city. The beetles were present in great numbers and many trees were entirely destroyed and others badly injured. The damage was almost invariably confined to the base of the lateral offshoots of the branches, the beetles burrowing under the bark and eating around the base of the twig causing its destruction. This attack, as characterized by Mr Knaus, is different from anything observed by the writer, unless the burrows passing around the twig are the work of larvae rather than adults

Description. The beetle varies in color from a light brown to black, is a very little over 1/16 inch long and relatively stout. The mouth parts apically and the eyes are black. The latter are coarsely granulated, transversely elongated and partly divided near their middle. The prothorax is rather coarsely and thickly punctured and tapers very much anteriorly. The wing covers or elytra are margined anteriorly, deeply striate and thickly clothed with short, yellowish hairs. Certain structural details of the antennae are shown on plate 67, figure 7 and that of the middle and posterior tibiae in figure 90.



Fig. 90 Middle tibiae: *a*—Tomicus balsameus; *b* Phloeosinus dentatus; *c* Posterior tibia of latter (original)

A pupa nearly ready to assume the adult form is yellowish white, about the length of the beetle and stouter. The eyes are brown and the mouth parts almost black. Four of the abdominal segments project beyond the wing pads.

The typical burrow [fig. 91, 92, and pl. 63, fig. 4] has a very characteristic form. There runs from the three lobed primary or nuptial chamber nearly parallel with the wood fibers a broad burrow about 3/4 inch long. Eggs are laid in minute notches on both sides of the parental channel and the young work for a short distance at nearly right angles and then they are apt to oblique in either direction. The larval burrows score the sap-

wood lightly at first but as the grubs increase in size the wood is entered more deeply, till nearly half the burrow may be therein

Natural enemies. This little insect appears to be kept well in check by natural enemies, of which a number have been recorded. Dr Hopkins lists the predaceous Phymatodera bicolor Say as an associate and Clerus quadrisignatus Say var. nigripes Say has been observed under red cedar bark with this insect. Several small parasites also prey on this species. Spathius canadensis Ashm., a species

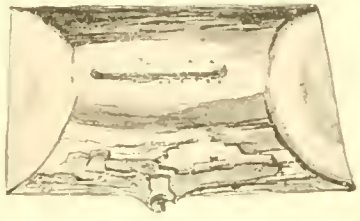


Fig. 31 Phlocotinus dentatus: adult gallery [illegible] (after Hopkins's illustration)

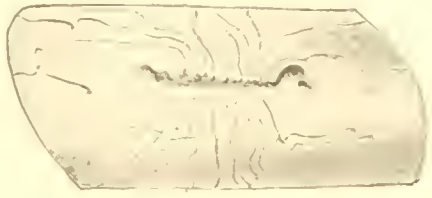


Fig. 32 Phlocotinus dentatus: [illegible] larval mines (after Hopkins's illustration)

of Pteromalus and a species of Eurytoma have been observed by Dr Hopkins preying on this borer. The writer has reared another small parasite from this insect which has been kindly determined by Mr Ashmead as Caudonia pityophthori Ashm.

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AMBROSIA BEETLES

This small group of insects is remarkable because the different species live on various succulent fungi carefully grown in their galleries. These interesting forms have been closely studied by the late H. G. Hubbard of the Division of Entomology, United States Department of Agriculture, and the following account is based on his published observations. These little wood borers are easily recognized by their somewhat elongate, cylindric form and specially by their habit of making uniform sized galleries in the wood of various trees. The burrows usually penetrate to a considerable depth, have a well marked design, and their walls are stained a bluish or black color by the fungus. The exits of the galleries are circular and from them are ejected minute white chips, which may frequently be observed on the rough bark or the ground beneath. These little beetles are remarkable for the care bestowed on their young, and in this exhibit characteristics foreign to most Coleoptera, and such as we expect to find only among the social bees, ants and their allies, and Neuroptera, such as the well known white ants.

These borers require special conditions for the propagation of their food fungus, and consequently can inhabit only certain trees. This fungus does not appear by accident but is carefully propagated by the mother beetle on a packed bed or layer of chips, sometimes near the entrance in the bark though usually at the end of a branch gallery. The ambrosia of some species is grown only in certain brood chambers of a peculiar structure, and in others in beds near what Mr Hubbard considers larval cradles. The excrement of the young is used in some and probably in all species, to form new beds or layers for the propagation of the fungi, the types of which have been described by Mr Hubbard, as follows: one has erect stems with swollen cells at the tips [fig. 105]; and another forms tangled chains or cells resembling the piled up beads of a broken necklace [fig. 54]. The erect or stem forms occur among species whose larvae live in galleries, such as Platypus and Xyleborus, while the beadlike kinds appear to be peculiar to

species whose young are reared in separate cells or cradles. All the growing parts of the fungus are extremely succulent and tender; the conidia specially are pellucid and glisten like pearls or drops of dew. These are produced in great abundance during active growth, sometimes appearing singly at the end of short, straight stems as in figure 105, and sometimes as grapelike clusters among interlacing branches [fig. 54]. The fungus appears at such times like hoarfrost on the walls of the galleries, and the very young nip off the tender tips somewhat as calves eat heads of clover, while the older larvae and the beetles devour the whole structure which soon springs up again. Mr Hubbard compares the growth of these fungi to asparagus, which remains succulent and edible only when cropped, and when allowed to go to seed is no longer useful for food. The ambrosia must be constantly fed on; otherwise it ripens, the cells burst and discharge their granules in such abundance as to fill the galleries, and the beetles may be overwhelmed and destroyed by the growth.

Disturbances in conditions necessary to growth are apt to promote the ripening of the fungus, a danger to which every colony of ambrosia beetles is exposed. Checking the natural increase of a populous colony of beetles also results in overproduction of fungus and disaster, because the superabundant growth chokes the galleries and often suffocates the remaining insects. The same untoward results may be brought about by closing the outlet of the galleries through the bark, or by spraying with kerosene or some other liquid. This throws the inmates of the galleries into a panic, and like other social insects, they gorge themselves with food and exhibit great concern at the threatened loss of this their most precious possession. They rush hither and thither, trampling on and crushing young, eggs and larvae, breaking down the delicate lining of the brood chambers and puddling it into a slush, which is pushed about and accumulates in the passage ways, completely blocking them. Breaking down of the fungus follows, and in a few days the galleries are filled with masses of spores or mycelium threads.

The limited conditions under which these fungi can be grown restricts

the life of a colony, and as a rule only two or three generations occur in a large tree trunk, while in smaller ones there may be only one brood.

A typical life history of these insects is well illustrated by Mr Hubbard's account of Xyleborus pubescens Zimm. A solitary female starts the galleries similar to those illustrated in figure 104. The branches serve as brood galleries and in each, five to six oval, pearly eggs are deposited. The young hatch within a week and begin feeding on the ambrosia at once. The pupae lie free in the galleries, and in somewhat over a month from the eggs perfect beetles appear. The colony, in time, contains beside the mother insect 15 or 20 adult offspring, most of which are females, only one or two males commonly being found. A second brood is started by this later generation, but the seasoning of the wood and threatening failure of food usually warn the young females to depart and seek fresher trees. This leaves the abandoned males in a sad condition, since they are unable to consume the ripened ambrosia, and they also wander forth, though wingless and weak, or are suffocated by the superabundant fungus. Sometimes they assemble in certain galleries and form bachelor colonies, where by united efforts they are able to check the fungus and prolong existence for a time. The watchful care of the mother for the young is well described in the notice of Monarthrum mali Fitch, page 291.

These little insects are of economic importance, principally on account of their injury to timber. A few species are known to affect living trees, though as a general rule their attacks are confined to dying or dead timber. The defects in the wood caused by the galleries of these beetles, and the stains left by the fungus, probably entail more loss than the injury caused by attacks on living trees. The presence of their galleries seriously depreciates the value of timber used as cask heads, staves, shingles and the like. These defects may be repaired to some extent by plugging, but those made by some species cannot be thus treated. It is possible in some instances to take advantage of the habits of the insects, and by proper sawing the damage may be reduced to a minimum. The soft wood in the Adirondack region is seriously affected by these little borers, and the quality of much of it greatly impaired.

White pine weevil

Pissodes strobi Peck

An oblong, dull-colored weevil, about ¼ inch long, frequently deposits eggs in the leading shoots of pine or other evergreen trees. The grub's work in the shoots and stem, causing an irregularly deformed tree of very little commercial value.

This is one of the commonest enemies of pine trees in New York State, and its work may be observed in practically every locality where they occur.

Early history. It was brought to the attention of the public early in the last century, by Prof. W. D. Peck of Harvard University who made a study of the insect and described it, and also ascertained certain important facts regarding its life history. It was studied later by Dr Harris who contributed in adding to our knowledge of its habits, and who states that the beetles are found in great numbers in April and May, on fences, buildings, and pine trees, and that they probably secrete themselves, during the winter, in the crevices of the bark, or about the roots of the trees, depositing their eggs in the spring. Dr Fitch studied the insect in New York, about 1857, presenting an account of it in his fourth report. He states that this species selects thrifty growing vigorous pines whose topmost shoot has made the greatest advance the preceding year. He observed that the insects were so numerous that in one grove not only the topmost shoots of every tree, but many of the lateral ones were attacked and destroyed. The depredations of this insect were also brought to the attention of the late Dr Lintner on several occasions, and Mr W. C. Pierce of Richford, as recorded by Dr Lintner in his ninth report, states that 150 Norway spruces which had been planted in a cemetery the preceding year, began to die at the top. Examination showed that small borers were working between the bark and the wood, in the topmost shoot and destroying the life of the trees. Dr A. D. Hopkins states that this insect infests the bark of logs and trunks of living and dying pines and spruce.

Description. The adult beetle is about ¼ inch long, reddish brown to a very dark brown, and with a somewhat peculiar whitish spot near the

posterior third of each wing cover. The beetle is also somewhat mottled with white on the sides and legs. The snout is rather long and stout and the legs somewhat so, as represented at plate 19, figure 7.

The creamy white pupa is about the same length as the beetle and in recently transformed individuals is nearly uniform in color, except for the dark brown eyes and the brownish tips of the mandibles. As the pupa ages the coloration begins to appear, and in rather old pupae the snout may be reddish brown, and the legs show traces of color. The tip of the last abdominal segment is ornamented with a pair of rather slender, curved spines.

The grub is a white, footless creature, varying in size according to the stage of development. The bark of the infested twig may have all of the inner bark and a portion of the sapwood reduced to a decaying mass of borings. The pupal cells in the example before us are entirely within the wood, nearly $^1/_4$ inch in length and set somewhat obliquely to the axis of the twig. There is a channel which is packed with borings leading obliquely from the pupal cell to the cavity under the bark [pl. 19, fig. 6].

Life history. The life history of this insect has been studied by a number of entomologists, and it may be summarized as follows. The beetles occur most abundantly in early spring, and it is probable that most of the eggs are deposited in the leading shoots at this time. Dr Fitch states that the female places her eggs in the bark of the topmost shoots of the tree, dropping one in a place at irregular intervals throughout its length, and that the worm or grub after hatching, eats its way inward and obliquely downward till it reaches the pith in which it burrows for a short distance, the whole length of its track being about $^1/_2$ inch long.

It frequently happens that so many eggs are placed on a shoot as to limit very closely the portion occupied by each grub, and therefore some of them are compelled to burrow in the wood outside of the pith, in order to avoid interfering with those nearby. When they are so close to each other that the burrow cannot be continued to its normal length, the larvae feed on the walls of their galleries, and thus obtain the necessary nourishment.

The attacked shoot continues its growth during the early part of the season, but soon the grubs cause so much injury that it begins to wilt and wither about the middle of July, and the tender parts above dry and perish. Examination of the affected shoot reveals small oval cells, about 1/3 inch long, placed lengthwise in the center of the stem. They are so very close in some cases that their ends are nearly in contact, and in others they are more or less widely separated by masses of borings, and not infrequently small cells may be found in the sapwood just beneath the bark [pl. 10, fig. 6].

Each of these contains a white plump larva or grub, which later changes to a pupa and the adult insects appear abroad next spring. Pupal cells of this weevil may also be found under the bark of pine logs and stumps. Mr L. H. Joutel has recently called the writer's attention to the breeding of this insect in the bark of a tree 6 inches in diameter, a fact previously mentioned. Dr Fitch was quite confident that eggs deposited in the spring become mature beetles within a year. This weevil was observed by the writer to be very common and injurious to white pines at Karner in 1901, and the following year he had an opportunity of studying recent work of the pest in small white pines at Salem N. Y. These observations indicate that the attack frequently begins just below the terminal whorl and is evidenced by the small irregular masses of pitch and the lighter color of the foliage above the point of injury. The larva or grub makes a longitudinal burrow in the inner bark, which is closely followed by a drying and shrinking of the tissues immediately above and adjacent to the wound, forming a darker, sunken area on the shoot. The work is extended downward under the bark to the next whorl and possibly below. The infested bark soon becomes a mass of burrows and decaying matter, eventually peeling off and revealing oval pupal cells in the wood. Its work was also observed here and there in other parts of the State. The record of captures by beating certain trees in 1901 may be of interest, as it shows the persistence of this species in small numbers, at least, throughout a long period. The record is as follows: June 4, 6; June 13, 18; June 19, 1; June 26, 2;

July 8, 1; July 19, 1; July 27, 5; Aug. 2, 1; Aug. 9, 6; Aug. 21, 11; Sep 6, 4; Sep. 18, 2; Oct. 23, 6. It was also taken in April and May 1902. It will be noted that in 1901 no collecting was done in May, and it is the writer's impression that the insect was not very abundant, as was the case in 1902, in that locality prior to the beginning of our operations. A study of this record shows that the beetles were more abundant from the 13th to the 26th of June, and from the 9th to the latter part of August. The tendency of this insect to breed more or less throughout the season is also indicated by the condition of a badly infested twig, received by the writer the last of August 1902. This small piece, about 3 inches long, was almost honeycombed by the insect and contained numerous pupal cells in each of which there was a pupa in a more or less advanced stage of development. One insect had emerged in transit, another one was almost ready to appear and the remainder would probably have forsaken their retreats before the approach of cold weather. It is interesting in this connection to note that Dr Hopkins found pupae in spruce bark June 27, and in white pine July 13, in yellow pine July 11, showing that some of the insects must develop later than early May. The later captures represent scattering individuals, and it would appear as though this insect bred more or less throughout the season, though as stated by the later writers, the principal brood may appear in May and early June.

Food plants. This weevil is well known as a serious enemy to most of our native pines and severe injury to spruces has been recorded by several writers.

Natural enemies. Dr Fitch has stated that after the infested shoot becomes withered and dry in midsummer one may observe that the bark covering the cells has been broken and peeled off in spots and that all its lower parts are torn away. Newly perforated holes larger than the burrows of this insect may be observed, here and there, in the wood. These, he states, are the work of small birds which are very efficient in devouring the larvae and the pupae of this pest. Dr Riley in his report for 1885 states that the grubs or larvae are exposed to many dangers from carniv-

orous foes, particularly the young of beetles belonging to the family Tenebrionidae and records finding young Ichneumon or Chalcid flies in their burrows. Messrs Riley and Howard have recorded the rearing of Bracon pissodis Ashm. from specimens of this insect received from Wellesley Mass. Dr A. D. Hopkins has also obtained Spathius brachyrus Ashm. in West Virginia.

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Pissodes dubius Rand.

A small, brownish, yellowish, flattened, long snouted beetle about 3/16 inch in length, may be met with on spruce in July.

A single specimen of this interesting insect was taken on spruce July 4, 1903, at Big Moose N. Y.

Description. The beetle is about 3/16 inch in length, brownish, with the thorax and wing covers flaked with golden, creamy yellow scales, with here and there a bunch of variable size. The thorax is very coarsely, almost contiguously punctured, and the wing covers are closely striated with a series of nearly contiguous punctures. It may be separated from its ally, P. affinis Rand., according to Dr LeConte, by the sides of the thorax converging a little near the hind angles, which thus become somewhat obtuse. There is also some difference in the scales on the elytra, which, in well preserved specimens are more diffuse with the markings less definite.

Distribution. This species has been recorded from Lake Superior, Canada and New Hampshire, and Randall states that he found it on a wharf in Boston on pine wood brought from Maine.

Pissodes affinis Rand.

This species resembles the common white pine weevil, Pissodes strobi Peck, and may be recognized by its larger size, it measuring about $\frac{5}{16}$ inch in length, and by the less conspicuous markings, specially the whitish spots on the posterior third of the wing covers.

A single example of this insect was taken by the writer on white pine July 26, 1901 at Bath-on-Hudson. Dr LeConte records this species from Lake Superior, Canada and New Hampshire.

Magdalis perforata Horn[1]

A small, jet-black weevil, $\frac{5}{16}$ to $\frac{1}{4}$ inch in length, may be met with on hard pine during June and July [pl. 20, fig. 17].

This species was specially abundant near the tips of the central shoots of hard pines at Karner in the summer of 1901, at which time it occurred in considerable numbers in association with the white pine weevil, Pissodes strobi Peck. It was taken at intervals during June and July, and was also met with in early June, 1902. It probably breeds in the terminal shoots, though we have not detected the work of its larvae. Very little has been recorded concerning this species. It was described from Georgia by Dr Horn, and has been listed from New Jersey by Dr J. B. Smith, who states that it is generally distributed, though rare, on pine.

Magdalis alutacea Lec.[2]

This species resembles the preceding closely, though it is smaller, measuring as a rule not over $\frac{3}{16}$ inch in length. It may also be distinguished by the more highly polished wing covers [pl. 20, fig. 16].

It was associated with the preceding on the terminal shoots of hard pines at Karner, and like it, probably bred in company with the pine weevil, Pissodes strobi Peck. It was taken on pines in 1901 as follows: June 4, 1; June 13, 5; June 26, 2; July 8, 2, showing that the adults are apparently abroad during a somewhat limited period. It was described by

[1] 1873 Horn, G. H. Am. Phil. Soc. Proc. 13: 453.

[2] 1878 LeConte, J. L. Geol. & Geog. Sur. Ter. Bul. 4, p. 463 (original description).

Dr LeConte in 1878, from specimens taken at an altitude of 9,000 to 10,000 feet in the Leavenworth valley above Georgetown Col. These two widely separated localities would seem to indicate a general distribution over the United States, and that it probably ranges into southern Canada, at least.

Pine tip moth

Pinipestis zimmermani Grote

Short, brown, needles on tips of hard pine, specially if there be a small pitch mass near the base of the injured portion, is an indication of the work of this insect.

This pernicious borer, kindly determined by Prof. C. H. Fernald from bred specimens, was met with on hard pines at Karner during June and July of both 1901 and 1902. It invariably attacks the more slender growing tips, frequently the leader or the central shoot of a branch, and causes them to shrivel, curl slightly and later turn brown. The work of this borer is frequently indicated by a small, granular mass of brownish pitch pushed out by the borer near the base of the injured portion. The needles on the affected parts are much smaller than normal. The insect is occasionally so abundant as to kill a considerable proportion of the terminal shoots and thus seriously injure the development of the tree, practically ruining it for other than firewood purposes.

Description. The moth is a pretty, slate gray and white insect with a wing spread of about $\frac{3}{4}$ inch [pl. 20, fig. 19]. The larva measures a little over $\frac{3}{4}$ inch in length, with the head and thoracic shield black and the body varying from reddish brown to somewhat livid green. Its dark brown tubercles each bear a slender hair and the skin is further ornamented by linear series of dark brown, blackish chitinous points. The presence of these latter are characteristic of this caterpillar, and permit its ready separation from the borer operating on the smaller limbs, (Evetria comstockiana Fern.)

Life history. Dr D. S. Kellicott records taking the larvae of this insect at Hastings, and states that they were a dull white and not livid, though otherwise as described by Grote. He adds that the larvae were found in

the vicinity of wounded areas on the trunk, and that they cannot penetrate the outer bark of other than tender trees or the branches of larger trees. He found galleries of the insect in both the trunk and branches above and below the whorls, and states that sometimes the borers completely girdle the stem and kill the portion above. The work described by Dr Kellicott was quite different from that observed by us at Karner and it may be that two species have become confused. A thin, papery cocoon is spun in July, as stated by Mr Grote, and the moth appears 10 to 14 days later. We have bred it the latter part of July.

Food plants. Mr Charles Zimmerman, for whom this species was named, records it on the following pines: Pinus strobus, P. rubra or P. resinosa, P. austriaca, P. sylvestris, P. cembra and on the Corsican, lofty Bothan and Russian pines. He states that Pinus sylvestris seems to suffer most, as the limbs and even the main stems are constantly breaking off. The hard pine, Pinus resinosa, is the common species at Karner, and we have yet to find the insect appearing on any other and in a manner different from that described above. Consequently, we are at a loss to account for its wide range of food plants and very different method of work noted by earlier writers, unless there has been a change in food habit or two species are under consideration.

Injuries. Dr Kellicott, writing of this insect in 1879, states that many small pines at Hastings, Oswego co. were seriously infested, and Professor Grote expressed the belief the same year that this insect caused more injury to young white pines than any other species.

Distribution. Dr Kellicott found this species at Buffalo, Cheektowaga, Hamburg and Clarence, Erie co. and Hastings, Oswego co. He also found it common in both cultivated and forest pines at Corunna Mich., it being especially destructive to small ornamental pines and spruces in a cemetery. He took eight pupae from the trunk of a single spruce.

Parasites. A parasite was found by Mr Grote filling the cocoons of this insect, and Dr Kellicott records the presence of this beneficial species in localities where the moth is abundant. He also bred another parasite from this insect but has not recorded its name so far as known.

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Nantucket pine moth

Evetria frustrana Scudd.

Infesting the new growth of Pinus inops, P. rigida, and perhaps of other species, spinning a delicate web around the terminal bud, and mining both the twig and the bases of the leaves; one or several small yellowish larvae, which transform within grayish cocoons, either in their burrows or fastened to the twigs, and become small copper-colored moths, with wing expanse of nearly ½ inch.

The work of this species was met with on hard pine at Karner in 1901. The insect was not specially abundant, and though infested tips were collected, no adults were reared. This species is a very serious enemy of hard pines on Nantucket Island. Professor Scudder, writing of this species in 1883, states that the pines set out on Nantucket Island 20 or 30 years before were dying in large numbers. He adds that a great many have perished, and that most of the living trees appear sickly. Miss Mary Treat records this species as most destructive to hard pines in the vicinity of Vineland N. J. Professor Comstock also received twigs infested by this insect from Prof. S. H. Gage of Ithaca. Dr A. D. Hopkins records the work of this species as very common along Alleghany Front, Mineral co., W. Va. He states that though the characteristic mines were found, scarcely any larvae or pupae were obtained.

Life history and habits. The following condensed account of the life history and habits of this insect is that given by Professor Comstock:

About the middle of May 1879, the scrub pines (Pinus inops) in Virginia, near Washington, were found to be greatly injured by small lepidopterous larvae. On many trees there was scarcely a new shoot to be found which was not infested at its tip by from one to four yellowish, black-headed caterpillars. They were so completely concealed while at work that their presence would scarcely be noticed, and the effect of their work was hardly visible, until the twig was almost completely destroyed.

Upon close examination a delicate web was seen inclosing the base of the bud and the surrounding new leaflets, resembling much the nest of a small spider. When this web was removed, one or several little caterpillars were seen either retreating into a mine in the bud or into the bases of the leaves, which were also mined, or, not infrequently, they dropped from the twig, suspending themselves by a silken thread. The bud was often so hollowed that it dropped to pieces almost at a touch [*see* pl. 20, fig. 3].

At the time when they were first noticed larvae of almost all sizes were to be found. Some were apparently almost full grown, while others had evidently not been long hatched. The nearly full grown specimens measured 8 mm (.31 inch) in length. The first pupae were obtained early in June. Most of the larvae transformed within the burrows which they had made, first spinning more or less of a silken envelop about themselves. Others, however, issued from their mines, and spun rather tough grayish cocoons between the leaves. The pupae were short, stout, and brown in color, with each segment furnished dorsally with two serrated lines, one consisting of large and the other of fine teeth.

The first moths issued June 13, the pupae having previously worked their way, by means of the spines just mentioned, into such positions that they could give forth the moths without injury to the latter, and a few weeks later almost every shoot had one or more of the empty pupa skins protruding from it.

In the latter part of August, individuals of the second brood were very abundant in the scrub pine in the vicinity of Washington. As before, they were found in almost every stage of growth, and the differences were even more marked. In one instance five larvae of greatly differing sizes were found in one shoot. The smaller ones were boring into the bases of the leaves, and the larger ones into the twig proper. The largest of the five had made quite a long channel from the tip of the bud down into the heart of the twig. Pupae were also found at this time, which did not give forth the moth until late in the winter.

The usual mode of hibernation is in the pupa state. A thorough search in January in the field showed only pupae. The pupae collected in August and September did not begin to give forth the moths in the breeding cages before early January; February and March this was continued through intervals, and was greatly hastened without doubt by the heat of the room. On Feb. 15, however, a few twigs were collected, from one of which, on Feb. 28, a full grown larva had emerged and was found crawling about the cage. This would seem to indicate occasional larval hibernation.

Parasites. Mr Scudder records the breeding of three hymenopterous parasites from this insect, one a species of Bracon, another, a minute Peri-

lampus, both of which he states to be undescribed. He adds that the latter is far more important.

Remedial measures. The only method of relieving the trouble, so far as Professor Comstock could suggest, was picking the infested tips in early winter and burning them, a measure practical only in the case of highly valued trees.

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Pitch pine retinia

Evetria rigidana Fern.

Inhabiting terminal shoots of Pinus rigida, and of similar habits to the Nantucket pine moth, Evetria frustrana Scudd., a gray, brown, or blackish larva ½ inch long, becomes a small moth with dingy white wings, marked with dark red and silvery gray.

This species was received in the larval stage by Professor Comstock in 1879, from Prof. S. H. Gage of Ithaca. The work of this species is stated to resemble that of Evetria frustrana Scudd., and the larva is described as differing in coloration, and being slightly larger. The moth possesses characters intermediate between E. frustrana Scudd. and E. comstockiana Fern.

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Pitch twig moth

Evetria comstockiana Fern.

Masses of pitch, usually on the upper side of the smaller limbs and twigs of hard pine, cover the entrance of a burrow made by a small yellowish white caterpillar about ½ inch in length.

The work of this insect was quite abundant on hard pine at Karner in 1901, and its operations have also been observed on many hard pines in the

eastern portion of the State. The work of this species is quite characteristic, in that the mass of pitch is on the upper side of the smaller limbs and twigs. Many of these pitch collections show two layers or masses of different age and this is specially true in the spring. The more recent layer is the record of the later activities of the caterpillar, which, boring in the center of the twig, carries the accumulating pitch out and deposits it around the entrance of its gallery [pl. 20, fig. 1].

Early history. This species was described in 1879 by Prof. C. H. Fernald, from examples sent him by Professor Comstock, whose attention had been attracted by its work. Professor Comstock records this borer as quite abundant in the vicinity of Ithaca N. Y. Dr Lugger has taken the moth at Baltimore Md., and Dr Hopkins states that this insect is common in West Virginia, on the living twigs of pitch pine near Kanawha Station, and adds that it is frequently observed wherever pitch pines grow. The writer has also observed the work of this insect in several localities in Massachusetts.

Life history. This species passes the winter in the larval or caterpillar stage, and at Karner, operations begin about Ap. 15. This is very nicely indicated by the fresh layers of pitch placed on the outside of masses exposed to the weather during the winter. The spring addition is frequently nearly equal to the accumulation of the previous season, and the demarcation between the old and the new is very evident. June 12, 1901, an empty pupal case was seen, but no adults were obtained in breeding cages till the 20th. Though a considerable number of the infested twigs were collected at various times during 1901, we succeeded in breeding the moth only during the month of June. Professor Comstock expresses the opinion that this insect passes through two generations in one season, though our data hardly bear out this conclusion. We have been unable to make any observations on the duration of the period during which the moth flies, or on the method of oviposition. The preparation for hibernation has been described by Professor Comstock. He states that the larva lines its burrow with a delicate layer of white silk, which often forms a closed tube at the lower

end. The larva remains in this case with its head toward its extremity, reversing its position before the transformation to the pupa occurs. Just before the disclosure of the moth, the pupa wriggles its way partly out of the burrow till it protrudes a short distance beyond the surface of the pitch mass, a procedure which enables the moth to escape without injury [pl. 20, fig. 1].

Description. The moth is a delicate, grayish brown mottled insect, having a wing spread of about $\frac{3}{4}$ inch [pl. 20, fig. 21].

The pupa is brownish, about $\frac{1}{2}$ inch in length, and the abdominal segments are each provided with two transverse rows of stout teeth. These are of great assistance to the pupa in wriggling out of its burrow.

The larva is about $\frac{1}{2}$ inch long when full grown, the head and thoracic shield are light brown, and the body a yellowish white. The labrum and tip of the mandibles are dark brown, the moderate tubercles are well chitinized and bear one or two setae. The spiracles or breathing pores are encircled by dark brown rings of chitin, and the anal shield is somewhat chitinized and ornamented with longer setae. This larva may be readily distinguished from the larger dark colored one of the pine tip moth, Pinipestis zimmermani Grote, by its not possessing linear series or dark brown, blackish, chitinized points on the body surface.

The egg is lemon yellow, elliptic-oval in form when deposited on the glass of the breeding jar, and nearly $\frac{1}{25}$ inch long.

The gallery or burrow of the caterpillar may be 2 or more inches in length. It is usually confined to the center of the twig, and may extend in one direction from the pitch mass or in both. The opening to the latter is kept clear, though usually there is a slight cover over the tip of the gallery at the surface of the pitch.

Parasites. It might be thought that a caterpillar having its burrow protected by a pitch mass would be safe from the attacks of parasitic insects. Such however is not the case, and this species is the host of at least two parasites which were bred by Professor Comstock; one is known as Ephialtes comstockii Cress., and the other is a species of

Agathis. An Ichneumon, Cremastus retiniae Cress., was reared from this insect by Messrs Riley and Howard. The writer also succeeded in breeding from this insect an exceedingly small four winged fly which was determined by Dr Ashmead as a species of Stenomesius.

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Pitch midge

Cecidomyia resinicola Osten-Sacken

Footless orange grubs occur in clear or whitish pitch masses on the underside of pitch pine branches.

This interesting insect has been under general observation at Karner for several years, where it was present in considerable numbers on some trees. The species may be easily recognized by the peculiar, whitish masses of pitch illustrated on plate 20, figure 2. They hang from the underside of limbs and occasionally occur in numbers on the central stem. During warm weather drops of pitch may fall at times from the masses.

Life history. The eggs of this species have been observed by Miss Lida S. Eckel, who states that they are bright orange and arranged regularly, projecting radially about the equator of the spherical pitch drop. She states that in the case of specimens under observation, eggs were deposited only on fresh pitch and never on old, hardened lumps or on twigs or leaves. No new masses of pitch appeared on the stems, as would have been the case had the insect punctured the bark for the purpose of starting an exudation. She therefore concludes that this insect takes advantage of fresh pitch masses, and as a rule there are plenty of them occurring under normal conditions. She states that the young larvae

creep beneath the surface of the pitch and rapidly grow to twice their original size, gradually making their way toward the portion of the twig from which the pitch is exuding. This results in their collecting in a group with their mouths close together and their bodies extending toward the surface of the mass. The very young larvae have hooklike spines on the ventral surface of each segment. These disappear with growth, and the entire skin becomes covered with fine, backward curving spines. After 15 or 18 days the young attained a length of from $^1/_8$ to about $^1/_4$ inch. Miss Eckel's observations demonstrate that the parent insects take advantage of normal exudations of resin on which to oviposit, and that the flow of this substance may be increased to some extent by the larvae rasping the living tissues. This latter is particularly liable to occur when the supply is somewhat deficient.

Adults have been bred by us during the latter part of June and in early October. They were also reared from material collected which was supposed to represent only the work of the pine twig moth, Evetria comstockiana Fern. It is not improbable that a few eggs may be deposited in pitch masses around the galleries of this borer and the larvae come to maturity under such conditions. The normal pitch mass inhabited by this little fly, may contain from two to about 30 larvae which, when full grown, measure about $^1/_4$ inch in length. They are a pale orange while feeding, and on the approach of maturity become a bright orange color. The larvae are elongated, widest about the middle, and the underside of segments 1 to 7 are each provided with two transverse rows of black or brown spines which probably aid in locomotion. Professor Comstock states that while they burrow in the bark and resin, the anal tubercles are always at the surface, thus permitting the insect to breathe, and when the larva contracts to a pupa, the end of the body is drawn in, though an open channel is left for the passage of air. The pupa works its way partly out of the pitch mass before disclosing the little midge, which has a wing expanse of about $^1/_3$ inch, the thorax gray and the abdomen in living specimens, a dark red.

Description. The original characterization of this insect by Baron C. R. Osten-Sacken is as follows:

Length .12 to .14 of an inch. Male antennae not much shorter than the body, of dark color, except the scapus, which is reddish; 2x24 [14] jointed, flagellum with small, subglobular joints alternating with double, subcylindrical ones; pedicels between the joints about equal to the diameter of the shorter joints, somewhat longer towards the end of the antennae, joints verticillate, the length of the hairs of the verticils not exceeding the length of joints. Female antennae less than half as long as the body, 2x12 jointed; joints of flagellum subcylindrical, more than twice longer than they are broad, the basal ones being the longest; pedicels short: the hairs, clothing the antennae, are shorter than each single joint. Head strongly gibbous above, which gibbosity is very striking, when viewed in front or from the side; the black eyes being absolutely confluent, and covering the whole gibbosity, occupy nearly the whole surface of the head, except a small space round and below the antennae and a portion of the occiput, which are brownish red (the brown predominating in several specimens). The ground color of thorax is reddish; the dorsal portion however, including the scutellum are grayish brown; rows of yellowish hairs indicate the direction of the ordinary stripes (when rubbed off these hairs show gray stripes under them); the middle stripe is divided in two by a grayish longitudinal line; pleurae and sternum reddish, mixed with brownish gray; abdomen reddish, with grayish-yellow hairs, long and erect along the sides, short and appressed on the back; genitals pale. Feet brownish, with a yellowish gray, appressed pubescence; some longer hairs on the underside of the femora; halteres with dark knobs. Wings gray, second longitudinal vein arcuated in its latter portion, ending immediately beyond the apex of the wing.

He states that the species can be easily recognized by the extraordinary shape of the head.

Parasites. This little insect in spite of its passing a large portion of its existence within pitch masses, is subject to parasitic attack. Miss Eckel, referred to above, has succeeded in breeding three species, as follows: *Syntasis diplosidis* Eckel, *Polygnotus pinicola* Ashm., and another belonging to the genus Eupelmus.

This insect can hardly be considered of much economic importance, yet we have observed trees which were seriously weakened by an excessive flow of pitch inhabited largely by the larvae of this species, and are therefore inclined to believe that in such cases some injury may be caused by

the larvae increasing the flow to such an extent as to seriously weaken a tree unable to stand a severe drain.

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LeConte's sawfly

Lophyrus lecontei Fitch

Dirty yellowish, red-headed, black spotted caterpillars feed in clusters on the outer branches of pines from which they strip the leaves.

This species is a rather common one although as a rule it is not injurious. It was first brought to notice by Dr Asa Fitch who characterized it in 1857, and described its work and the adult female as follows:

When nearly matured these worms are so large that the end of a single leaf of the pine probably furnishes them a very insufficient mouthful, hence two worms often unite, standing face to face, and thus hold the five leaves which grow from each sheath on the white pine pressed together in a bundle as they eat it, commencing at the tip and gradually stepping backwards as the leaves become shorter. It is only the old leaves of the previous year's growth which these worms consume, never touching the new ones at the outer end of the limb; hence they injure the tree much less than they would were they to strip the limbs they invade of the whole of their foliage. At least two broods of these worms appear annually, the one in July, the other in September and October, the latter often remaining on the trees after the frosty nights have occurred. Having finished feeding, they leave the tree and inclose themselves in cocoons under fallen leaves or other shelter on the surface of the ground, in which they remain during their pupa state.



Fig. 25. Lophyrus lecontei, enlarged (Fitch)

The female. Length, .38 inch to the tip of the abdomen, and .48 inch to the end of the wings. It may at once be distinguished from all our other described species by the joints of its antennae, which are 21 in number. It is shining dull, tawny yellow, with the antennae black, and also the abdomen and base of the thorax. The underside is paler yellow, with two broad, black stripes on the abdomen. The wings are smoky hyaline, their veins black. Captured the middle of May.

The full grown larva is about an inch long, the head red and the body pale yellowish with subdorsal and sublateral rows of triangular black spots, one on each segment. True legs black, prolegs pale yellowish [pl. 19 fig. 8].

This species, as stated by Dr Riley, has been observed feeding on Scotch and Austrian pines in New Jersey. There are several sawfly larvae having the same general appearance and habits as this species.

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Abbott's pine sawfly

Lophyrus abbotii Leach

Yellowish, black headed, black spotted, false caterpillars nearly an inch in length, defoliate white and hard pines from midsummer till late fall.

This species is a common one in New York State and occasionally inflicts considerable injury, particularly on young trees, though as a rule it is present here and there in relatively small numbers. The caterpillars are gregarious and consequently their work is very apparent because entire branches are quickly defoliated. The ravages of this species are by no means confined to New York, it having been reported from a number of other states and Canada, and Dr Smith has recorded an outbreak in New Jersey, which resulted in the defoliation of about 50 acres. This is very exceptional. Dr Packard states that the insect is so abundant on Cape Cod as to threaten the existence of plantations of young pines. There are probably two generations, the larvae of the first appearing in midsummer and those of the second in September and October. The larvae, when disturbed, throw back the head and move the upper portion of the body in a manner very similar to that of species of Datana. Many can be dislodged by violent shaking. The larvae spin their brownish, oval cocoons among the leaves, and adults of the first generation appear about the middle

of August. The adults of the second generation winter in the cocoons. The eggs are deposited in little slits in the leaves. Dr Riley states that some of the flies appear early in the spring, while others do not issue till the latter part of June. A single parasite, Limneria lophyri Riley, has been reared from this species.

Description. The adults have been described by Mr Saunders practically as follows:

The male has a wing spread of about $\frac{1}{2}$ inch and the female of $\frac{2}{3}$ inch. The body of the male is black, excepting the yellowish underside and tip of the abdomen. The female is honey-yellow, with the head and thorax a little darker, the thorax with the abdomen being slightly marked with black. The wings are transparent with black veins.

The full grown sawfly larva has a black head, the body is yellowish white and is ornamented with two rows of oblong square black spots down the back. On each side there is another row of about 11 black, nearly square spots, they being a little longer than broad.

Fir sawfly

Lophyrus abietis Harr.

Clusters of black headed, dark green, dark striped caterpillars about $\frac{1}{2}$ inch long, defoliate fir, spruce and pitch pine in midsummer and probably early fall.

This sawfly is one of the rarer species occurring on hard pine. It was taken by us in small numbers on hard pine at Karner in early June and again the latter part of July. It is probable that this species, like its allies, has two generations, the first produced by adults which hibernate in the cocoons and the second from sawflies emerging about midsummer. This species has been recorded from several northeastern states and Canada, and Dr Fletcher states that Mr Harrington obtained the larvae of this form from spruce and apparently the same thing occurred very abundantly on white cedar.

Description. The full grown larvae have the head yellowish or black and the body a dull green with a pale dorsal stripe; in some specimens the stripe is lighter on the posterior portions of each segment. There is also a subdorsal and stigmatal paler stripe. The true legs are black and the false

or abdominal legs pale yellowish with dark green bases [pl. 20, fig. 6]. The cocoon is cylindric, ovoid, silvery white and about 5/16 inch long. The adult has been characterized by Dr Harris substantially as follows:

The male is 1/4 inch long with a wing spread of about 2/5 inch. The body is black above, brown beneath and the wings are transparent with changeable tints of rose-red, green and yellow. The legs are a dirty leather yellow color. The antennae resemble short black feathers, wide at the end, narrowed to a point and are curled inward on each edge so as to appear hollow. The female is about 3/10 inch long and with a wing spread of 1/2 inch or more. She is yellowish brown above, with a short blackish stripe on each side of the middle of the thorax. The body beneath and her legs are paler, of a dirty yellow color, and her wings resemble those of the male. The antennae are short, taper to a point, consist of 19 segments and are serrate on one side.

Spruce bud worm

Tortrix fumiferana Clem.

Trees dying in masses or clumps of greater or less extent are very likely affected by this species.

The spruce bud worm has been characterized by Dr Packard as the most destructive enemy of spruce in certain portions of Maine. He and others have placed on record a number of instances of severe injury resulting from this insect's work. This is due, as observed by Mr Kellogg, to the fact that there are in the spruce but a few buds, usually two or three at the end of a twig, and if they are destroyed the tree does not reproduce them till the following year. This makes it very easy for an insect feeding on these portions to inflict very serious damage.

Description. Young larvae have been described by Dr Packard as uniformly pale green with a yellowish tint. The head is dark brown, the thoracic shield amber, with two dots on the posterior margin; hairs about half the length of the body thickness. Length about 3/32 inch. Just before the last molt they are uniformly rust-red brown with the tubercles duller, the head and thoracic shield black. The full grown larva has an unusually thick, stout body tapering gradually from the middle to the end and slightly flattened from above. The head is not quite so wide as the body, a very dark brown, though lighter than before the last molt.

The pupa is very thick, the thorax being unusually swollen. The body, soon after changing, is a pale horn color, striped with brown; antennae and legs dark horn color or dull tan brown. The moth has been described by Clemens as follows:

Fore wings brown, varied with dark brown, short striae. The basal patch is indicated by dark brown striae, but the central fascia is not indicated. Following the basal patch is a grayish brown space having a shining luster; its exterior edge is irregular and it widens toward the dorsal margin, where it bears short, dark brown striae. About the middle of the costa is a round spot of the same hue and luster, and along the terminal margin is a stripe with irregular margins, of the same hue and luster bordered on each side with dark brown. Sometimes the grayish luster is absent on the markings, which are then simply of a paler brown than the general hue; hind wings dark fuscous.

Life history and habits. Dr Packard states that injured trees look as though a light fire had passed through them. The larva feeds on the leaves or needles of the terminal shoots of both the first and previous year's growth. It gnaws the base of the needles, separating them from the twig, meanwhile spinning a silken thread by which the needles and bud scales are loosely attached to the twig. The caterpillar moves about freely and does not live in a regular tube, though sometimes it draws together two adjacent shoots. Its presence is hardly noticeable till the caterpillars are abundant enough to partly defoliate trees. They are usually most numerous in June and early July, occurring on firs and hemlocks, in addition to spruce. The caterpillar attains full growth from about the 20th to the 30th of June, at which time it transforms to the pupa in its rude shelter or hiding place under the loose leaves of the infested shoots, and about six days later the parent insect appears. The pale green, scalelike, flat eggs are laid in patches, the eggs overlapping each other irregularly, leaving about a third or fourth of the surface of each exposed. Hatching occurs in about 10 days, and the young caterpillars feed for a while and pass the winter in a partly grown condition among the terminal shoots of the tree, completing their transformations the following June and July. Professor Fernald bred from this caterpillar a parasite, Pimpla

conquisitor Say, though as a rule this insect appears to be remarkably free from the attacks of natural enemies.

Distribution. This species occurs in New York, New Jersey, and has been listed by Dyar from the northern United States.

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Larch sawfly

Lygaeonematus erichsonii Hartig

A greenish yellow sawfly larva frequently defoliates larches in midsummer.

This insect has been repeatedly brougnt to the attention of the writer and also to that of his predecessor, Dr J. A. Lintner, on account of the serious injury inflicted in recent years on the larches or tamarack of the Adirondacks.

Early history. Dr A. S. Packard states that his attention was first called to this species in August 1882, when he saw the effects of its work at Brunswick Me. It at that time had partly or entirely stripped the larches in the very wet swamps on the banks of the Androscoggin river. He found that most of the trees, both large ones 6 to 10 inches in diameter, and small saplings 6 to 15 feet in hight, had been attacked and that some of the trees had been stripped, others partly defoliated, and still others had escaped injury, those in the middle of the swamp appearing to have suffered most. He also published several extracts from local papers of that year, all of which were to the effect that the larches had been very seriously injured by this imported insect. Its work was observed at Franconia N. H., in the same year by Prof. W. W. Bailey and it also attacked larches in various parts of Massachusetts. The work of this species was observed in New York State July 25 and early in August 1883 at Horicon and Pottersville, Warren co., and at Schroon Lake in Essex county, as stated by Dr Packard. The trees were defoliated by the first of August and the affected region was very extensive, covering many

square miles in different swamps. It was reported "from Schroon Lake to North Elba and about Mount Marcy." The work of this sawfly was observed on larches during the years 1884 to 1886 in several counties of northern New York by State Botanist Peck, who kindly reported the depredations to Dr Lintner. Again in 1887, larvae of this insect were received by Dr E. L. Sturtevant of the State Agricultural Experiment Station from Mr E. Phelps of De Kalb Junction. The abundance and destructiveness of this pest is well described in the following notice from the *St Lawrence Republican* of July 27, 1887.

Mr David Page of Jerusalem Corners, in this town, has given us an account of a remarkable pest of worms which recently infested his premises. There are three larch or tamarack trees growing in his dooryard. About July 7, very soon after the extremely hot weather set in, a few worms appeared upon them, feeding upon the leaves. The next day they had doubled in number, and in a day or two had become a countless host, completely covering the trees, so that the end of the finger could not be placed even on the trunk of one of them without touching one or more of the worms. They also covered apple and maple trees and shrubbery, and the grass beneath, but ate nothing, so far as could be discovered, except the leaves of the tamarack. They swarmed upon the house and piazza, and it became necessary to sweep them from the latter every few minutes. They accumulated in little windrows along the house. The countless hordes of worms became an object of great curiosity and interest to people of the neighborhood, and Mr Page and his family became really alarmed as to the result of this invasion; but in scarcely a week from the time of their appearance they disappeared as rapidly as they had come, and in a day or two none of them were to be found. The tamaracks were left as bare as in winter, but no other signs of damage were visible. Whether the worms had gone into the ground or what had become of them seems not to have been ascertained.

The work of this insect was also brought to Dr Lintner's attention the same year from Cherry Valley, Otsego co., by Rev. Henry U. Swinnerton, and a brief paragraph published in the *Country Gentleman* July 14 of that year doubtless refers to the work of this insect at Sharon. The following account of personal observations by Dr Lintner in the southern portions of Hamilton county, gives a very good idea of the seriousness of its attack.

All of the larches within sight of the stage route from Newton's Corners, at the foot of Lake Pleasant, to Sageville at its head, a distance of 4 miles, had been almost entirely stripped at the earliest date above named. The trees of this species of which there are many, in some places it being the prevailing growth, could be recognized at the greatest distance from which they could be seen by their nakedness, appearing as if dead, which undoubtedly some of them were, as the result of the previous defoliation. The elevation above tide of Lake Pleasant is 1800 feet. Not all of the larches in the vicinity had been wholly stripped. A large one of 18 inches in diameter at three feet from the ground and reaching upwards to a hight of at least 70 feet, standing alone in a pastured lot, and throwing out long and thick branches, had its foliage less than one half eaten. From a large number of larches of a moderate hight of 15 feet and under that were entirely free from harm, it appeared that the younger trees were not sought by the parent sawfly for oviposition. Whenever they had been eaten, they were in the immediate vicinity of larger trees, which, having been stripped, the migrants from them, in their search for food, may have been able to ascend with difficulty in small numbers, such of the smaller ones as chanced to be in their way. The tips of these small larches gave no evidence of oviposition in them.

He adds that this attack was also observed by him in the Lake Placid region during the summer of 1888. This insect continued its ravages and in 1891 Dr Lintner observed that many of the larches from the road passing through Wilmington, and the Mountain View in North Elba, Essex co., were nearly or entirely stripped of their leaves. Considerable numbers of dead larches were seen which he thought had been killed by the annual defoliations by this insect. This insect has been injurious in later years, and has undoubtedly killed a great many larches or tamaracks in the Adirondack region. It has also extended its ravages here and there to ornamental trees. The investigations of the writer in 1900 showed that the pest was present in numbers in the Saranac Lake region, and that many larches suffered from its work, and later observations in the vicinity of Boonville in 1902, showed that larches in that section were injured more or less by this pest.

Life history. The life history of this insect has been given by Dr Packard as follows:

The eggs are laid in the terminal young shoots of larch from about the

middle of June in Massachusetts, to the early part of July in northern Maine, the larvae feeding on the leaves late in June and in July and early August. The young are nearly full grown by the last of July or first week in August, according to the latitude. Still a few occur on trees in Massachusetts, as late as the last week of August or early September.

Dr Packard states that it is very doubtful if there are two broods. He observed at Brunswick Me., that all the eggs had hatched by June 23 or 28. They are placed in two rows, alternately, not exactly parallel, one being placed a little in advance of the other, and are inserted at the base of the fresh young partly developed leaves of the new shoots, which are usually at this time only about 1 or 1½ inches in length. The presence of the eggs causes a deformation of the shoots, which curl over, the incisions being in all cases observed on the inner side of the shoot. Dr Packard has described the operations of egg laying as follows:

The sawing the slit in which the eggs are placed requires about 5 minutes. The two sets of serrated blades of the ovipositor were thrust obliquely into the shoot by a sawing movement, the lower set of blades being the most active, and sliding in and out alternately. After the incision is sufficiently deep, the egg is expelled through the inner blades of the ovipositor.

Dr Packard states that though the slit is at first closed, as soon as the embryo increases in size the twigs swell where they have been cut and the slit enlarges and gaps more or less, and thus affords ready egress for the newly hatched larva, which rarely eats the terminal shoots, but crawls on the leaves of the whorls next thereto. It first nibbles one side of the needle or leaf, leaving it half eaten and rough, serrate, and partly withered along the edge. The presence of the injured leaves is of great aid in detecting the young sawfly larvae, which collect on the verticils of the larches after they have shed their first skin and almost invariably begin to eat the needles one after another. In this way one verticil after another is devoured and when the larvae are half grown, they occasionally collect around the main stem of the twig in singular clusters, with the hinder part of the body curled over the back. Owing to the oblique position in reference one to another, they look much like a ball

of worms when in this posture. "The larvae appear to attain their full size in about 5 to 7 days after hatching, certainly not more than 10 days." There appear to be three molts. On gaining maturity, the larvae descend from the tree and spin oval elongated cocoons beneath the moss or other convenient shelter, where they remain unchanged during the winter, transforming to the pupa the next spring. The following characterization of the different stages is taken from Dr Packard's descriptions.

The egg is slender, cylindrical, tapering towards each end, slightly over $^{1}/_{25}$ of an inch in length.

The very young larvae have dusky or smoky green heads, and uniform pea-green bodies. After the first molt, the body is a pale green and without the glaucous pearly bloom of the latter two stages. The head and thoracic feet are black and the segments wrinkled as in the adult.

After the second molt, the larva has the peculiar bloom mentioned above. The body is a pale pea-green beneath, and on the lower portion of the sides. The black spines of the abdominal segments are as distinct as in the full grown caterpillar.

The fully developed larva may be recognized by its round jet-black head and the peculiar glaucous green color of the body which resembles that of the underside of the leaf. There are no lateral stripes or spots. The thoracic segments are unmarked, but around each abdominal segment, except the second, there are parallel double rows of minute dark dots or warts [pl. 18, fig. 11].

The oval, brownish cocoon is $^{2}/_{5}$ of an inch in length and one half that in diameter.

The adult sawfly is a large thick black species, with the second and fifth and part of the sixth abdominal segments a bright resin-red.

Distribution. This insect appears to have become well established over a considerable proportion of Canada and the New England States, New York and Pennsylvania, and it will probably thrive wherever the larch exists.

Introduction. Dr J. A. Lintner states that this species was observed at the Arnold Arboretum at Brookline Mass. in 1880 by Prof. C. S. Sargent, who discovered the larva feeding on some European larches. Specimens were submitted at this time to Dr H. Hagen who identified the species. This is the first record of the insect's occurrence in America.

Parasites. Dr A. S. Packard records the rearing of a number of

minute Chalcids belonging to the genus Pteromalus and for which, in case the species proves undescribed, he proposed the name of P. nematicida. He states that this beneficial species was so abundant as to infest nearly every cocoon transmitted to him by one correspondent. He also records several plant bugs, one similar to Podisus spinosus Dallas, as preying on the sawfly larvae. Dr Lintner observed this plant bug feeding on the sawfly larvae. He states that the full grown caterpillars were fearlessly seized and firmly held till their fluids were extracted.

Remedial measures. There is very little that can be done in checking this insect in native swamps. Valued trees on lawns can be protected from injury by thorough spraying with an arsenical poison. It is very probable that one of the prepared forms of arsenate of lead would prove most effective.

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Pine needle gall fly

Cecidomyia pini-rigidae Pack.

The basal enlargement of shortened, deformed pitch pine needles contain at certain seasons thick orange colored larvae.

The work of this interesting gall fly was met with at Karner during several years, though at no time was it excessively abundant. The attack was in most cases confined to one or two tips on the tree and a considerable proportion of the needles would be affected, indicating that the female probably remains on one branch and deposits a large proportion of the eggs at the base of adjacent developing needles [pl. 20, fig. 4]. This insect was observed by its describer, Dr Packard, at Brunswick Me., in 1862 or 1863. He found the larvae in September of that year and states that when fully developed it forsakes the gall, ascends to the terminal buds and

pupates on one side exposed to the air. He adds that there are sometimes two larvae in a gall, one on each side of the leaf. The cocoons are described by him as pale, oval and covered with pitch which exudes from the buds of the tree. They were found May 20. At maturity the pupa wriggles partly out of the cocoon and through the adhering pitch, permitting the fly to emerge readily from the projecting case.

Life history. The life history of the species has been summarized by Dr Packard as follows:

The eggs are probably laid at the base of the needles early in May and possibly the preceding autumn or the larva may winter in this gall, though this does not appear probable. They pupate at the base of terminal buds, spin silken cocoons about the middle or the third week of May and the fly probably appears in the early part or the middle of June and deposits eggs which give rise to the brood we have found in September.

He finds that a large percentage of the insects are destroyed by a Chalcid parasite. The insect was under our observation during several years and July 27, 1901, very small larvae were met with in affected needles. On the 20th of the following June a few deformed needles were found among the old foliage, young larvae were to be seen and flies were bred July 23. These latter, however, were possibly adults of Cecidomyia resinicola Osten-Sacken, to which this species has been referred by Kertész. The great difference in larval habits leads us to question the correctness of this synonymy and for the present we prefer to treat it as a distinct species.

The work of this insect was again observed July 15, of the same year, at which time the malformation was well developed in new grown needles. It will be seen that our observations substantiate in a general way the life history as outlined by Dr Packard.

Description. The following description of the larva and female is that given by Dr Packard:

Larva. Deep orange in color, with the "breast-bone" retractile. The lateral swollen region of the body is well marked, convex, and the segments are short, quite convex.

Female described from life. Antennae 14-jointed, about half as long as the body, brown, with sparse, irregular verticils of gray hair, the 10 terminal joints twice as long as broad, and pedicellate. Clypeus and epicranium testaceous brown, the clypeus (hypostoma) having a few long gray hairs curving over and downward. Palpi concolorous with the ends of the antennae.

Thorax shining black, with four lines of white hairs, as in C. pini DeGeer; the sides including the prothorax, reddish; scutellum reddish brown, while the trochanters are much darker, the first pair being nearly black, the two posterior pairs reddish brown. Legs brown, paler beneath, with gray hairs, the tarsal joints darker at the articulations, covered with fine silvery hairs.

Wings rather short and broad, with scarcely any pubescence; fringe long, veins dark brown; the subcostal (first longitudinal) vein terminates at the middle of the wing (in C. salicis it terminates much beyond this point); the median vein terminates at or perhaps a little below the apex; it curves around rapidly, following the curve of the margin; cross vein very minute, very oblique, almost obsolete, situated a little below the middle of the first longitudinal vein; third longitudinal vein straight, but turning down to the inner margin at nearly a right angle. The venule which, in continuation of the main vein, is bent upward at its origin, thence goes straight to the outer edge, inclosing a triangular space. The halteres are pale flesh-colored.

Abdomen blood-red, with slight sparse hairs. The segments on the terminal half of the abdomen are edged with black, and the tip of the abdomen is blackish, while the genital armature is flesh-colored. Length .10 inch.

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INSECTS OF MINOR IMPORTANCE AFFECTING FOREST TREES

This division is purely an arbitrary one and made as a matter of convenience because it enables the bringing together of accounts relating to species which are more or less injurious from year to year. Many of the insects noticed in this latter section, are of considerable importance and occasionally may cause serious injury. This division is defective in that it involves looking in several places in order to learn about the insects affecting a tree, and this difficulty is remedied in part by indexing all the species under their food plants as well as under their generic and specific names.

INSECTS AFFECTING DECIDUOUS TREES

Borers in living or relatively sound wood and bark

A stout beetle about an inch long and beautifully marked with dark brown, silvery and reddish yellow, bores in hickory... Beautiful hickory borer, Goes pulchra, p. 431

A brownish gray beetle about 7/16 inch long, and with very long, slender antennae, occurs on oak..... Liopus punctatus, p. 432

A small, grayish, black-spotted beetle about 1/4 inch long, may be bred from dead twigs of oak and other trees..... Hyperplatys maculatus, p. 432

A narrow, triangular, blackish beetle 1/4 inch long, marked with lines and spots of yellowish or orange, occurs on various flowers in June

Mordella octopunctata, p. 433

A slender, flattened beetle with red prothorax and bluish wing covers, mines as a larva the inner bark of dead and dying trees; also injurious to tan bark

Variable oak borer, Phymatodes variabilis, p. 433

A stout, brownish, gray-spotted, long-horned beetle about an inch in length, may be bred from oak, walnut and hackberry

Dusty oak borer, Romaleum atomarium, p. 434

A stout, brown, grayish mottled, long-horned beetle occurs in midsummer on oak and various trees, the larva is an oak and pine borer. Urographis fasciatus, p. 434

A black beetle about 1/2 inch long, with brick-red wing covers marked with reddish yellow spots, occurs on scrub oak..... ..... Typocerus velutinus, p. 436

A small grayish weevil 1/8 to 3/16 inch long occurs on oak foliage, the larva tunnelling the wood ..... Gray sided oak weevil, Pandeletejus hilaris, p. 436

A black, clearwing moth with red-spotted wings and yellow-banded legs and abdomen, may be reared from oak galls..... ..... Sesia rubristigma, p. 437

A golden yellow and black wasplike, clearwing moth having a wing spread of 1 1/2 inches, is very injurious to red oak..... *Memythrus simulans*, p. 438

A brown-headed, greenish larva with rose-colored elevated points, about 1 1/2 inches long, bores in black oak

Lesser oak carpenter worm, *Prionoxystus macmurtrei*, p. 439

A small, black, yellowish, gray-marked, long-horned beetle may be reared from dead limbs of hickory, oak and other trees..... *Leptura quercii*, p. 439

A black beetle about 3/8 inch long, variably marked with dark orange red, occurs on scrub oak..... *Leptura vagans*, p. 440

A grayish, narrow, triangular beetle from 3/8 to 1/2 inch long, may be met with on hickory in early June..... *Tomoxia bidentata*, p. 441

A narrow, triangular, brownish, gray-marked beetle about 1/16 to 5/16 inch long, occurs on decaying hickory in early June..... *Tomoxia lineella*, p. 441

A small, cylindric, stout, black, red-shouldered beetle about 1/5 inch long, makes short, curved galleries in the branches of a number of deciduous trees

Red-shouldered twig borer, *Sinoxylon basilare*, p. 442

A flat-headed, yellowish white grub bores in the trunk and limbs of pignut hickory, transforming to a flattened, hard-shelled, lurid, dull brassy colored beetle

Lurid Dicerca, *Dicerca obscura* var. *lurida*, p. 442

A stout, black beetle with golden yellow spots and transverse bars on its wing covers, occurs on chestnut, oak and hickory in midsummer.. *Calloides nobilis*, p. 443

A slender, blackish, gray-marked beetle about 5/8 inch long, mines as a larva the inner bark and sapwood of chestnut and oak

Thunderbolt beetle, *Arhopalus fulminans*, p. 444

A black, slender, cylindric, long-horned beetle about 3/8 inch long, is easily reared from hickory twigs..... *Dorcaschema nigrum*, p. 444

A brownish black, red-bordered beetle about 1/2 inch long, bores as a larva in hickory

Red-edged Saperda, *Saperda lateralis*, p. 445

A small, jet-black beetle about 1/4 inch long and with an oblique white line on each side, works in hickory and chestnut branches..... .... *Euderces picipes*, p. 445

A cylindric, brownish beetle about 3 1/16 inch long, makes holes of nearly uniform diameter in hickory and oak..... Hickory timber beetle, *Xyleborus celsus*, p. 446

A short, stout, black beetle about 1/16 inch long, may be bred from hickory twigs

Hickory twig borer, *Chramesus hicoriae*, p. 448

A slender, odd looking larva with a prominent hump on its neck, and leaflike, fleshy appendages at the end of its back, excavates extensive galleries in the heartwood and sapwood of living and dead chestnut and oak

Chestnut timber worm, *Lymexylon sericeum*, p. 449

A brownish, flattened beetle about ½ inch long, occurs on chestnut, the larvae mining the inner bark ..... Callidium aereum, p. 450

A beautiful, black, golden-marked beetle about 5/8 inch long, occurs on various trees in June ..... Leptura zebra, p. 450

A blue black, clearwing moth about ¾ inch long, with yellow-banded legs and abdomen, bores as a larva under chestnut and dogwood bark..... Sesia scitula, p. 451

A minute, brownish, rather stout beetle about 1/10 inch long, runs transverse galleries in the inner bark of peach, plum and cherry

Peach bark beetle, Phloeotribus liminaris, p. 452

A blue black, clearwing moth having a wing spread of an inch and with narrow, yellow bands on the abdomen and legs, lives as a larva under the bark of plum and several related trees..... Sesia pictipes, p. 453

A red-horned, red-legged, black, brilliant greenish beetle about ½ inch long, occurs on butternut, oak and birch..... Gaurotes cyanipennis, p. 454

A flattened, jet-black snout beetle about ¾ inch long, bores in butternut, poplar and other woods..... Cossonus platalea, p. 455

A slender, light brown beetle about 1 inch long, bores in butternut and beech

Centrodera decolorata, p. 456

A purplish, black, yellow-marked, red-tailed, clearwing moth with a wing spread of about ¾ inch, bores as a larva in maple..... Sesia corni, p. 456

A flat brassy beetle with divergent wing covers, works in peach, cherry, beech, maple and other deciduous trees..... Divaricated buprestis, Dicerca divaricata, p. 457

A brilliant green, golden yellow, flat beetle about 5/8 inch long, bores in maple

Banded buprestid, Buprestis fasciata, p. 458

A slender blackish, wasplike insect bores as a larva in diseased maple

White-horned maple borer, Xyphidria albicornis, p. 459

Dark brown or black beetles about 1/32 inch long, make longitudinal burrows in partly decayed sugar maple limbs..... Xylocleptes species, p. 460

Small worms similar to young apple borers sometimes occur in multitudes under the bark of apple and maple trees..Prickly Leptostylus, Leptostylus aculiferus, p. 461

A stout, black beetle 5/8 inch long, with brownish wing covers ornamented with three lines, occurs on elm..... Physocnemum brevilineum, p. 462

A light brown beetle about ¾ inch long, at the base and about the middle of each wing cover, pairs of ivorylike, oval elevations, bores as a larva in ash, hickory and honey locust..... 4-marked ash borer, Eburia quadrigeminata, p. 462

Slender, flattened, tortuous galleries in ash, 1/8 to 1/16 inch in width, cutting the wood largely, may be the work of this species..... Obrium rubrum, p. 463

A large, brownish, yellow-marked and yellow-banded, clearwing moth with a wing spread of 1½ inches, bores as a larva in ash..... Memythrus asilipennis, p. 464

A sawfly larva bores in the partly decayed wood of standing birch and makes a gallery about ⅛ inch in diameter..... Xyphidria provancheri, p. 465

A horntail borer making moderately large, cylindric burrows in decaying birch
Slender birch horntail, Konowia attenuata, p. 466

A flattened, brilliantly colored, purplish or bluish beetle about ¼ inch long, occurs in May on birch and other deciduous trees..... Chrysobothris azurea, p. 467

A slender, brownish beetle ranging from about ¾ to nearly 1¼ inches in length, bores in the larval stage under the bark of yellow birch and maple
Bellamira scalaris, p. 467

A brownish, white-striped caterpiller about 1 inch long, bores commonly in herbaceous stalks and the more tender twigs of maple and ash
Stalk borer, Papaipema nitela, p. 468

A brownish, cylindric beetle works in the stumps of recently cut yellow birch, causing an excretion of sap, which gums the rust-colored borings to the outside of the affected wood..... Birch bark borer, Dryocoetes sp. p. 468

A small, black beetle with gray or yellowish gray vestiture, is sometimes bred from willow
Saperda mutica, p. 469

A blue black, clearwing moth having a wing spread of ⅞ inch, bores in willow in the larval stage..... Sesia albicornis, p. 469

A steel blue, clearwing moth with a broad abdominal band and the fore wing tips red, bores willow canes in the larval stage..... Sesia bolteri, p. 470

A black, clearwing moth with three conspicuous yellow abdominal bands, lives in the larval stage in Saperda galls on willow and poplar
Three banded clearwing, Memythrus tricinctus, p. 471

A large, brown, yellow-marked, clearwing moth having a wing spread of 1¼ inches, lives as a larva in willow and poplar trunks..... Aegeria tibialis, p. 472

A large, brown and yellow-marked, clearwing moth having a wingspread of 1¾ inches, lives as a larva in roots of willow and poplar..... Aegeria apiformis, p. 472

A rather stout, blackish beetle irregularly marked with gray, occurs in June on poplar and hickory..... Acanthoderes decipiens, p. 473

Girdling the trunks of sapling poplars or running a mine around them, causing a swelling twice the diameter of the tree, a cylindric, slaty gray beetle about ½ inch long
Saperda concolor, p. 474

A small, brown or black, coarsely punctured beetle about ⅜ inch long, may be bred from galls of balsam poplar..... Saperda populnea, p. 474

A small, brownish black, yellowish-specked weevil about ¼ inch long, occurs in early spring under poplar bark..... ..... Dorytomus parvicollis, p. 475

A small snout beetle about ⅛ inch long, irregularly clothed with grayish pubescence, occurs under poplar bark in early May..... Dorytomus vagenotatus, p. 475

Stout, white naked caterpillars about 1½ inches long, bore in poplar trunks
Poplar carpenter worm, Cossus centerensis, p. 476

A pale whitish caterpillar bores in the smaller twigs of locust and causes a thickened, irregular growth, 1 to 3 inches long
Locust twig borer, Ecdytolopha insiticiana, p. 478

A yellow-marked, black beetle almost ½ inch long, may be bred from woodbine, sumac and possibly poison ivy..... Woodbine borer, Saperda puncticollis, p. 478

A jet-black, highly polished curculio about ⅛ inch long and with strongly grooved wing covers, occurs on ampelopsis or Virginia creeper, poison ivy and grape
Madarellus undulatus, p. 479

Irregular, gall-like swellings at the base of alder stems followed by dying and breaking of the shoots..... Alder borer, Saperda obliqua, p. 480

A small, legless grub boring irregularly in dead sumac and other twigs, may be the young of this beetle..... Liopus alpha, p. 481

A small, thick, long-horned, brown or chestnut-colored beetle about ¼ inch long, with ash gray markings, may be bred from the dead twigs and wood of a number of trees
Spotted Leptostylus, Leptostylus macula, p. 482

Borers in dried, usually manufactured wood

Pin holes less than 1/16 inch in diameter and galleries of the same size running in various directions in wood, may contain linear, black, white marked beetles about 3/16 inch long
White marked powder post-beetle..... Lyctus parallelopipedus, p. 483

Burrows about ½ inch in diameter may occasionally be observed in telegraph poles, doors, posts and similar places, and a large, dusky winged bee seen going in and out
Large carpenter bee, Xyloc opa virginica, p. 484

Borers in decaying wood or species found under decaying bark

A large, rather stout, black, white-marked beetle 1½ inches long, bearing two conspicuous eyelike spots, is frequently met with in decaying wood
Owl beetle, Alaus oculatus, p. 485

A thick, fleshy, legless grub about 3 inches long when full grown, bores in roots and stumps of a number of trees..... Broad-necked Prionus, Prionus laticollis, p. 486

A rather slender, brown beetle about 1½ inches long and less than ½ inch broad, lives in the larval stage in decaying trees
Lesser Prionus, Orthosoma brunneum, p. 487

An olive, gray-mottled beetle with black head and thorax and about ⅝ inch long, occurs in early spring on partly decayed beech stumps

Anthophilax attenuatus, p. 488

A brown-headed, black-winged, rather stout beetle about ¼ inch long, was bred from larvae taken from a hollow oak . . . . . *Dermestes pulcher*, p. 489

For less important species taken under decaying bark or in decaying wood, *see* p. 489–494

Fungous beetles

There are a number of species formed on various fungi growing on trees, and some of the more common are noticed briefly on p. 494

Natural enemies of one kind or another are frequently found in association with the above named species, and they are noticed briefly on p. 499–505

Beautiful hickory borer

Goes pulchra Hald.

A stout beetle about an inch long and beautifully marked with dark brown, silvery and reddish yellow bores in hickory.

The parent insect is a stout beetle, about 1 inch long, beautifully clothed with dark brown, silvery and reddish yellow pubescence. There is a broad, transverse, lighter band across the wing covers, and the tips of the latter are conspicuous on account of the golden pubescence covering them [pl. 9, fig. 1].

This insect deposits its eggs on different varieties of hickory, frequently selecting smaller trees only an inch or thereabouts in diameter. The operations of the grub inside young trees, causes the trunk to enlarge so that there is produced a gall-like swelling, which weakens the tree and may result in its breaking off in a gale. Old borings are marked by an ugly wound [pl. 9, fig. 3]. Recent operations of the larva are shown at figure 4, its characteristic feedings at the base of leaf stems and the exit hole of the parent beetle are represented at figures 2 and 5 respectively, plate 9.

This species is not abundant in New York, if one may judge from the condition of the State collections. This may be due in part to the retiring habits of the adults. It was reported a number of years ago by Dr Hodge as scarce, though found every season in shagbark and pignut hickory, about

Buffalo. Dr Smith states that this species occurs throughout New Jersey during June and July on hickory, having been noted by all recorders.

Liopus punctatus Lec.

A brownish gray beetle about $^{3}/_{16}$ inch long and with very long, slender antennae occurs on oak.

This very small dainty longicorn with enormously developed, slender antennae, is a rare species. Only two examples were taken June 26, 1901 on scrub oak at Karner. This little beetle is about $^{5}/_{16}$ inch long, of brownish gray color, inconspicuously and somewhat variably marked with black and white. It may be separated from the other species of the genus, according to Mr Wickham, by the convex front, the slightly retracted mouth, the lateral prothoracic spine being somewhat distinct from the base and by the elytra lacking distinct tufts of erect scales, and having a feebly marked post median band of whitish pubescence in place of the angulate line.

This species has been recorded by Dr Smith from several New Jersey localities and he gives Cornus floridus and plum as food plants. Messrs Leng and Hamilton record this species from Wisconsin and Canada.

Hyperplatys maculatus Hald.

A small, grayish, black-spotted beetle about $^{1}/_{4}$ inch long, may be bred from dead twigs of oak and other trees.

This, one of the prettiest of our long-horned beetles, is noteworthy because of its extremely slender, black antennae, which are longer than the body. The thorax is broader than long, dark brown, covered with a grayish pubescence, with a pair of large black spots on the anterior third, and ornamented with conspicuous lateral spines near the posterior third. The wing covers are thickly clothed with a grayish pubescence, bear numerous rather large, circular, black spots and are terminated by a pair of blunt spines. The femora are distinctly clubbed.



Fig. 94 Hyperplatys maculatus (original)

This species is a general feeder, it having been taken on dead twigs of orange, apple, hickory, poplar, oak, maple, yellow locust, beech and also sumac. It appears to have a general distribution in the northeastern United States, since it has been recorded from West Virginia, New Jersey, New York and the vicinity of Cincinnati O.

Mordella octopunctata Fabr.

A narrow, triangular, blackish beetle ¼ inch in length, marked with lines and spots of yellowish or orange, may be met with on various flowers in June.

This, one of the prettiest species belonging to the genus, may be quickly recognized by the linear buff markings on the thorax, and the yellowish or orange markings on the wing covers. There are, in the specimens before us, six well defined dots on the wing covers, with a somewhat irregular yellowish M on the base of the elytra.



The larva has been found by Riley, in oak stumps, and he states that it has a yellowish white head with three distinct yellowish lines above. The legs are short and the posterior extremity pointed, horned and blackish brown.

This species has been listed from the Middle and Southern States by Dr LeConte, has been reported as rare in southwestern Pennsylvania by Dr Hamilton, while Ulke states that it, with other species, occurs on bushes and flowers. Dr J. B. Smith records it from a number of New Jersey localities, it being rated in some places as rare, and in others as common.

Variable oak borer

Phymatodes variabilis Fabr.

A rather slender, slightly flattened beetle with red prothorax and bluish wing covers, mines as a larva the inner bark of dead and dying oaks, and is also injurious to tan bark.

This beetle is rather common in midsummer. The slender, reddish antennae are a little longer than the body and rise between the deeply emarginate, rather finely granulate eyes. The face of the insect is reddish brown with a slight blackish area between the bases of the antennae. The

sides and dorsum of the head are jet-black, coarsely and irregularly punctured. The thorax is dark brown, slightly swollen, and with an indistinct, darker area on each side. The dark bluish wing covers are rather finely and irregularly punctured and with a distinct ridge extending from the humeral angle and reaching about the middle of the wing cover at the posterior fourth. Femora, apically much dilated, black; basal portion reddish, the tibiae and tarsi the same color. This species is generally recognized as an oak borer. It also infests hickory and Dr Smith states that it occurs in great numbers in oak cord wood.

Dusty oak borer

Romaleum atomarium Drury

A stout, brownish, gray-spotted, long-horned beetle about 1 inch in length, may be bred from oak, walnut, hackberry and the dry leaf stems of palmetto.

This species is a typical, long-horned beetle a little over an inch long. The slender antennae are longer than the body and rise between the eyes, which latter are deeply excavated and rather coarsely granulate. The prothorax is rounded laterally and ornamented dorsally with three distinct tubercles arranged in a triangle, the posterior one being median and clothed with a thick, yellowish pubescence. The brownish wing covers are also thickly clothed in spots with a yellowish pubescence, giving the insect a dusty appearance. Dr Hopkins states that the larvae occur in stumps and logs of recently dead oak, and it has also been recorded from walnut and hackberry and the dry leaf stems of palmetto.

Urographis fasciatus DeGeer

A stout, brown, grayish-mottled, long-horned beetle occurs in midsummer on oaks and various trees; the larva is an oak and pine borer.

A specimen of this insect was obtained from hard pine bark brought from Karner, June 18, 1902. This beetle was early brought to the notice of Dr Fitch, who bestowed on it the common name of Quercitron bark borer.

Description. Beetle, rather stout, about ½ inch in length, the female

with a stout ovipositor extending about 3/16 inch beyond the tip of the wing covers. The antennae are slender, ringed with grayish white, and about one half longer than the body. The head, thorax and body are obscurely and somewhat irregularly marked with grayish brown and silvery white. The thorax is broader than long and armed laterally with a stout spine a little behind the middle; wing covers rounded at the base. Mr Wickham separates this species from its ally, *C. triangulifer* Hald., by its more elongate form, grayish pubescence on the upper surface, except for the dark markings consisting of small closely placed spots and blotches; these latter form a distinct line on each side of the middle of the prothorax, usually also an antemedian and postmedian, irregular elytral band.

The larva is a little over 1½ inch in length, and has been described by Dr Fitch as having a more or less retracted head, its base white and anterior portion deep, tawny yellow, black along each side. The body of the grub tapers slightly backwards to the middle, from whence it has nearly the same diameter to the bluntly rounded tip. There is a large, transverse, tawny yellow spot on the upper side of the prothoracic segment, occupying its basal half, and an elevated, rough, transverse, oval spot of the same tawny yellow color on the middle of all the other body segments, except the last two.

Life history and habits. Dr Fitch states that the bark of recently felled black oaks, *Quercus tinctoria*, are mined by borers belonging to this species, they forming large worm-eaten tracks. Transformation to the pupa occurs in the cavity, and the long-horned beetles appear in June. In Dr Fitch's time the species was so abundant that unless the bark of the black oak was peeled immediately after the tree fell, it became much worm eaten and worthless for dye purposes.

Food plants. This beetle appears to have a somewhat varied food habit. Besides occurring in pine and oak, as stated above, it has been reared by Mr Chittenden from chestnut, oak and maple, and Mr Beutenmüller also records it in addition from hickory, limbs of chestnut, and on the authority of Mr Jeutel, from apple and pear. Mr Dury records taking it on beech in the vicinity of Cincinnati.

Distribution. This species has a wide distribution in the eastern United States and Canada, since it has been recorded from Canada south to Louisiana, and as far west as Lake Superior and Wisconsin. It also appears in a number of local lists.

Typocerus velutinus Oliv.

A black beetle about ½ inch long with brick-red wing covers marked with reddish yellow spots occurs on scrub oak.

This, one of our more common longicorns, occurs on scrub oak in small numbers at Karner. The beetle measures about ½ inch in length. The head and thorax are black, the latter being bordered anteriorly and posteriorly, in well marked individuals, by a fringe of golden yellow hairs. The wing covers are brick-red, variously marked with reddish yellow spots, there being two large ones at the basal angle, two on each wing cover at about the basal third, one near the median line and another near the anterior border, and a larger spot at the distal third with a more faintly indicated one near the tip. It is abroad in July.

This species has been recorded by Dr Smith as common throughout New Jersey and it has been listed by Dr Hamilton from Sparrow lake, Ontario.

Leptura emarginata Fabr.

This large, beautiful longicorn has been found ovipositing in the limbs of white oak by Mr Joutel.

Gray sided oak weevil

Pandeletejus hilaris Herbst.

A small, grayish weevil from ⅛ to 3/16 inch long, occurs on oak foliage from May to September, the larva tunneling the wood.

This species was taken in large numbers on scrub oak at Karner, Sep. 18, 1901, and was present in greater or less abundance during the summer. It may be separated, according to Dr Horn, from the allied P. cinereus Horn, by the tip of the rostrum being entire and without a smooth space.

The thorax is also different in that it is dilated, pyriform, with the anterior narrower part much shorter than the posterior.

Description. The beetle has been described by Harris as follows:

A little pale brown beetle, variegated with gray on the sides. Its snout is short, broad, and slightly furrowed in the middle; there are three blackish stripes on the thorax, between which are two of a light gray color; the wing covers have a broad stripe of light gray on the outer side, edged within by a slender blackish line, and sending two short oblique branches almost across each wing cover; and the fore legs are larger than the others. Length from $\frac{1}{8}$ to $\frac{1}{5}$ of an inch.

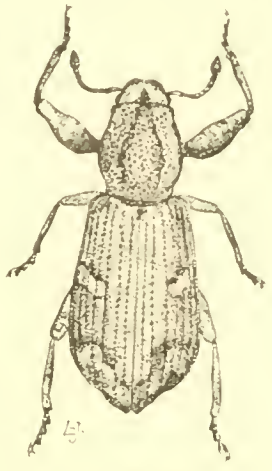


Fig. 96. Pantomorus hilaris (Original)

The larva of this form has been characterized by Packard, as like that of the plum weevil. It makes a smaller gallery than Eupsalis minuta Drury, and according to Harris, lives on the trunks of white oaks. It has been recorded on white oak by Dr Hamilton in southwestern Pennsylvania, and by Dr Smith in New Jersey, who states that it occurs throughout the state in the trunks of white oak and also on beech.

Distribution. This species ranges from New York to Texas and has been recorded from a number of eastern localities.

Sesia rubristigma Kellicott

A black clear wing moth with red-spotted wings and yellow-banded legs and abdomen may be reared from oak galls.

This species occurs in New York, Ohio and Iowa, and was bred from the galls of Andricus cornigerus on Quercus palustris by the late Dr Kellicott, moths being obtained in June and July.

Male. Head blue black, orbits pure white, palpi with basal joints black, second joint black except the tip, which is yellow, as is the whole of the third joint. Antennae black. Collar yellow. Thorax black with a yellow mark posteriorly and a yellow patch on each side below. Abdomen black with a narrow yellow band on the second and last segments, and a broad one on the fourth segment encircling the body; first segment with a spot on each side. Anal tuft black with a narrow yellow line on each side.

Legs blue black, varied as follows: anterior coxae, fore tibiae, all the tarsi, the spurs, and a band at the middle and apex of the hind tibiae, yellow; the tarsi, however, have some dark scales, appearing faintly banded. Fore wings transparent, purple black, borders very narrow. Discal mark square, bright red. Underside with borders yellow to the discal mark, which is the same as above. Hind wings transparent, borders very narrow, purplish, costa orange red; underside similar to the upper.

Female. Similar to the male. The outer margin of fore wings much broader, with red scales between the veins. Anal tuft with a distinct yellow lateral line.

Expanse. Male and female, 16–18 mm. *Beutenmuller*

Memythrus simulans Grote

A golden yellow and black, wasplike clearwing having a wing spread of 1½ inches is very injurious to red oak.

This insect has seriously injured the red oaks in St Anthony park, Minnesota, according to Dr Lugger, every tree showing numerous holes from which the moths had issued and in many cases the empty pupal cases were projecting from them. Adults appear in Minnesota from the end of May and throughout the month of June, some trees harboring hundreds of the borers in the trunk and larger limbs. The recorded distribution of this species has been given as Rhode Island, New York, Pennsylvania, New Jersey, Illinois, Iowa and Minnesota.

Description. Head black, orbits of eyes bright lemon yellow; palpi black at base, otherwise lemon yellow. Antennae black with a steel blue reflection. Collar lemon yellow. Thorax black, patagia at tips, a transverse posterior mark and spot at base of fore wing, yellow. Anterior coxae yellow; femora black, marked with a little yellow; tibiae yellow and orange; tarsi orange. Abdomen black with a broad bright yellow band on the posterior edge of each segment, those of the posterior segments much widened; sometimes the first to fourth segments have the bands very narrow and the last three segments are wholly yellow. Underside similar to the above. Forewings thinly clothed with dull orange brown scales, bordered with deep brown black along the costa and inner margin, discal mark slightly indicated. At the base of the wing is a short transparent streak, and at the hind angle is a transparent area. Underside paler than above, washed with orange. Hind wings transparent, with opalescent luster, margin very narrow brown.

Expanse. 27–35 mm. *Beutenmuller*

Lesser oak carpenter worm

Prionoxystus macmurtrei Guer-Men.

A brown-headed, greenish larva, with rose-colored elevated points, about 1½ inches long, bores in black oak.

This species is closely allied to the carpenter worm, P. robiniae Peck, noticed on page 79 and has very similar habits. It appears to be much rarer than its larger relative, though we have met with pupal cases in the Adirondacks which seemed referable to this species.

Description. Dr Fitch describes the moth as slightly smaller than P. robiniae, with thin, slight, transparent wings crossed by numerous black lines, the outer margin only of the fore pair being opaque and of a gray color. The hind wings of the male are colorless with the inner margin broadly blackish and the hind edge coal-black.

The larva has been characterized by Dr Lintner as an inch and a half long, pale green with a darker green dorsal stripe bordered faintly with yellow. Head flat, subtriangular, dark brown clouded with black. First segment with two brown spots extending across it, narrowed laterally, and of nearly the length of the segment medially where they unite to enclose on the dorsal line an elongate elliptical green spot. The anterior segments are flattened, and broader than the following, which gradually diminish in breadth toward the posterior end. The segments are marked dorsally with four rose-colored elevated points forming a square on the 10th and 11th segments. A similar spot occurs above each spiracle, a smaller one below and another in front, each tipped with a short brown hair. The spiracles are oval, orange colored with brown centers.

Lepturges querci Fitch

A small, black, yellowish gray marked, long-horned beetle may be reared from dead limbs of hickory, oak and other trees.

Two specimens of this interesting little species were reared from dead branches of hickory limbs taken at Ilion N. Y., May 17, 1902, the insects issuing June 10 and 11. This tree was badly infested by a knotty, gnarly growth, and presumably was in far from a thriving condition.

Description. This little longicorn is about 3/16 inch in length, black, with irregular markings of yellowish gray on the wing covers. Seen from

above, there is a broad, transverse band of yellowish gray pubescence across the anterior portion of the wing covers, broken by two long reniform spots near the median line and a large quadrate one laterally. There is also a patch of yellowish gray, with a central black spot at the extremity of each wing cover. The slender antennae are nearly twice the length of the body, with the tips of the segments slightly darker.

Life history and habits. This species was met with by Dr Fitch on red and white oaks. It has been recorded as common on hickory by Dr Hamilton, and Dr Smith states that it has been bred from oak, hickory and redbud in New Jersey, while Mr Chittenden has reared it in addition from limbs of butternut.

Distribution. This beetle has been recorded by Messrs Leng and Hamilton from Canada, Michigan, New York, New Jersey, Pennsylvania, Ohio, and it has been listed by Mr Ulke from the District of Columbia. It also appears in local lists of insects taken in the vicinity of Buffalo N. Y., Cincinnati O., and is reported as occurring abundantly in southwestern Pennsylvania, while Dr Smith states that it is found throughout New Jersey.

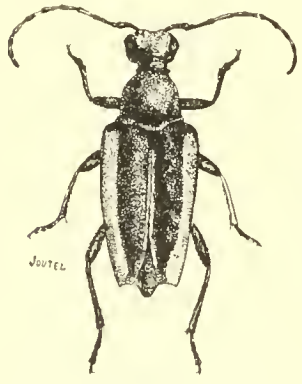


Fig. 97 Leptura vagans, enlarged (original)

Leptura vagans Oliv.

A black beetle about 3/8 inch long, variably marked with dark orange red occurs on scrub oak.

A single specimen of this small longicorn was taken on scrub oak at Karner in 1901. The adult beetle is about 3/8 inch long, with the head, thorax and a variable portion of the wing covers coal-black, the remainder dark orange red. In one specimen the black portion is represented by a somewhat lenticular, median spot on the side of the elytra, while on another there is only a rather narrow orange colored line on the humeral ridge of each wing cover. The head, thorax and wing covers are coarsely punctured.

This species has been recorded from a number of New Jersey localities

by Dr Smith, who states that it has been bred from butternut, hickory and birch.

Tomoxia bidentata Say

A narrow, triangular, grayish beetle from 3/8 to 1/2 inch long, occurs on hickory in June.

This species was obtained in some numbers June 8, from decaying hickory at Albany. It has a very close resemblance to T. lineella Lec., though the grayish, linear markings are not so distinct. It may be recognized, according to Dr Smith, by the long, triangular last joint of the maxillary palpi, and by the base of the thorax being rounded at the middle. The elytra are marked with broad bands not extending behind the middle, and with the posterior fascia composed of spots, a cinereous apical margin and a rhomboidal dark spot each side, near the base. This species was collected June 29 on dying hickory by Dr Hopkins, and Dr Smith records it from various New Jersey localities on dead trees, but nowhere common. Dr John Hamilton states that it is not common in southwestern Pennsylvania about old trees. It was described by Say from Missouri, and Dr Smith lists it from the Middle and Western States.

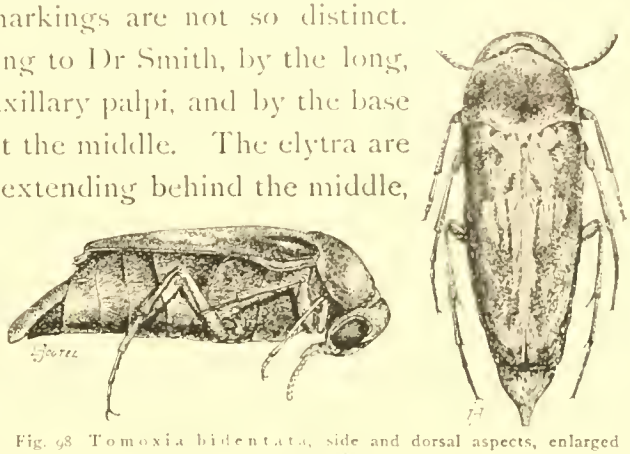


Fig. 98 Tomoxia bidentata, side and dorsal aspects, enlarged (original)

Tomoxia lineella Lec.

A narrow, triangular, brownish, gray-marked beetle about 3/16 to 5/16 inch long, occurs on decaying hickory in early June.



Fig. 99 Tomoxia lineella, enlarged (original)

This rare species was obtained in some numbers from a decaying hickory at Poughkeepsie, June 4, 1903. It has somewhat variable linear grayish markings on the head and thorax, and has been recorded by Ulke as occurring on old twigs in the District of Columbia, and Dr Smith reports it from dead trees.

He also states that it is much rarer than T. bidentata Say, from which it may be distinguished by the form of the maxillary palpi and the markings. He has seen specimens from Ohio, but has not learned of its occurring beyond the Mississippi. Dr John Hamilton records it as not common in southwestern Pennsylvania.

Red-shouldered twig borer

Sinoxylon basilare Say

A small, cylindric, stout, black, red-shouldered beetle about 1/5 inch long, makes short, curved galleries in the branches of a number of deciduous trees.

This small borer is rather uncommon in New York State, though it has been recorded as breeding in the twigs of a considerable variety of trees such as hickory, persimmon, mulberry, apple, peach and grapevine. Dr Hopkins states that it infests most other deciduous trees and that the larvae bore in solid wood.

Description. This small beetle is black or very dark brown with a variable area on the shoulders reddish. The antennae are light rufous with the terminal portion composed of three enlarged segments and a smaller one. Head coarsely and irregularly punctured; thorax strongly rounded, tuberculate anteriorly. Wing covers rather coarsely punctured and with several inconspicuous striae. Declivity straight and bordered above with three conspicuous teeth. Length about 1/5 inch.

This species is probably generally distributed in the northeastern United States, since it has been recorded from New York, New Jersey, the vicinity of Cincinnati O., and Minnesota.

Lurid Dicerca

Dicerca obscura var. *lurida* Fabr.

A flat-headed, yellowish white grub bores in the trunks and limbs of pignut hickory, transforming to a flattened, hard-shelled, lurid, dull brassy colored beetle.

This rather pretty borer was bred in considerable numbers from a badly galled hickory branch taken at Ilion, May 17, 1902.

Description. The beetle is a flattened, hard-shelled insect ranging

from about 5/8 to almost 3/4 inch in length. It is a lurid brassy color above and a bright coppery underneath. The tips of the wing covers diverge slightly and each bears a pair of small spines.

The larva is a yellowish white color, long, narrow, depressed in form and with abruptly widened thoracic segments. The head is brownish, small, and largely concealed by the prothorax. The mandibles are tridentate, black, the antennae very short. The prothorax is short and transverse, the mesothorax is oval, broader than long, and much depressed or flattened; the following segments are much narrower, gradually becoming longer.

Life history and habits. We bred this insect from hickory limbs June 10 and July 1, and Dr Harris states that this species occurs during the greater part of the summer on the trunks and limbs of hickories. The larvae make shallow burrows in sickly and dying limbs. This species is recorded from West Virginia by Dr Hopkins, who met with specimens May 2.

Distribution. This borer is common in the Middle, Southern and Western States, according to Dr LeConte, and appears in a number of local lists for the northeastern United States.

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Calloides nobilis Say

A stout, black beetle with golden yellow spots and transverse bars on its wing covers occurs on chestnut, oak and hickory in midsummer.

This rare insect is a magnificent beetle closely related to the very destructive sugar maple borer, Plagionotus speciosus Say, which it resembles in general structure. It probably has somewhat similar habits. This very dark brown or black beetle may be instantly recognized by the three bright yellow spots at the base of each wing cover, the smallest being at the extreme margin, in connection with the two somewhat transverse lines of the same color across the apical half. This attractive insect is rare in our collections and is probably not very abundant, though its pre-

sumably retired habits enables it to escape observation to a large extent. A specimen was taken at Albany June 13, and it occurs in the vicinity of New York city. It has been recorded from Massachusetts, the District of Columbia and southwestern Pennsylvania. It probably inhabits the northeastern United States, possibly ranging north into Canada.

Thunderbolt beetle

Arhopalus fulminans Fabr.

A rather slender, blackish, gray marked beetle about 5/8 inch long, mines as a larva the inner bark and sapwood of chestnut and oak.

This beautiful insect may be recognized by the peculiar oval, black spot on the prothorax, surrounded by yellowish white pubescence, and also by the much smaller, oval, more lateral spots of the same color. The black antennae are nearly as long as the body and rise between the somewhat conspicuous, deeply emarginate, finely granulate eyes. The black wing covers taper posteriorly and are irregularly marked with a whitish pubescence, frequently forming a series of W-like marks, the extreme tip of each wing cover bearing a rather conspicuous, oval, grayish area. This species has been recorded by Dr Hopkins as infesting the sapwood of hemlock. Beetles were taken by him in West Virginia in April, May, June, July and August, indicating an extended adult existence. Pupae were met with about the middle of April, and eggs in August.

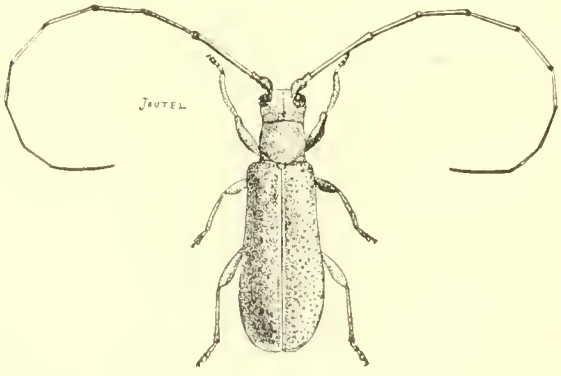


Fig. 100 Dorcaschema nigrum, enlarged (original)

Dorcaschema nigrum Say

A black, slender, cylindric, long-horned beetle about 3/8 inch long, is easily reared from hickory twigs.

This species occurs in several localities in the State, and was taken at Poughkeepsie on hickory June 2, 1903. It may be easily recognized by the long antennae, entirely black color and cylindric form, the

prothorax being tubularly narrowed behind the middle and with a rugose disk. The elytral punctures are deep, not very large or crowded, and the under surface is clothed with a pale pubescence, giving a leaden effect. This insect appears to be confined to the hickory, from which it has been bred by a number of entomologists. It has been recorded by Messrs Leng and Hamilton from New York, Massachusetts, Canada West, northern Illinois, Louisiana, has been bred from hickory in southwestern Pennsylvania by Dr Hamilton, found flying in a spruce forest in West Virginia by Dr Hopkins, and listed by others from the vicinity of Buffalo N. Y., Cincinnati O., and the District of Columbia. Dr Smith records it from a number of localities in New Jersey.

Red-edged saperda

Saperda lateralis Fabr.

A brownish black, red-bordered beetle about ½ inch long, bores as a larva in hickory.

This species is rather rare and exhibits a marked preference for injured portions of hickories near the root and the base of sprouts on recently cleared land. The larvae frequently work along the juncture of dead and living bark and inhabit the base of dead shoots. This species has been recorded from alder, though this appears to be an exceptional food plant.



Fig. [illegible]

Euderces picipes Fabr.

A small, jet-black beetle ¼ inch long, and with an oblique white line on each side, works in hickory and chestnut branches.

This small beetle presents a somewhat general resemblance to an ant because of the snowy white, oblique stripes on either side near the middle of the wing covers. The prothorax is strongly constricted behind and inclosing most of the head, assists in this deception. The antennae are about as long as the body and the femora strongly swollen. This little species is not abundant enough to cause material

injury. It has been recorded from a number of Northern States, and has been taken on linden, beech, hickory and chestnut.

Hickory timber beetle

Xyleborus celsus Eich.

A cylindric, brownish beetle about 3/16 inch long, makes holes of nearly uniform diameter in hickory and oak.

This species was bred in considerable numbers out of hickory logs from trees killed by the hickory bark borer, Scolytus quadrispinosus Say, at Geneseo N. Y.

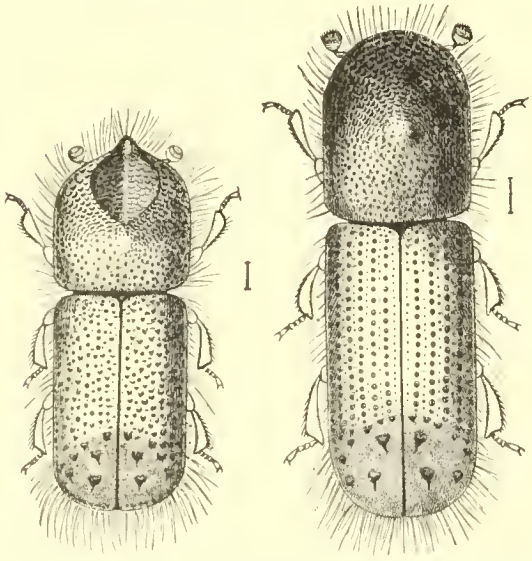


Fig. 102 Female and male of Xyleborus celsus (After Hubbard, U. S. Div. Ent. Bul. 7, n. s. '97)

Description. The beetle is about 3/16 inch long, rather slender, almost cylindric in shape, with the tips of the protruding mouth parts slightly darker. The prothorax and elytra are rather sparsely clothed with slender, yellowish hairs, and there are two prominent and a number of less distinct tubercles on the somewhat steep declivity. This species, according to Dr LeConte, differs from X. dispar Linn. by its much more elongate form, the thorax being about one half longer than wide, with the sides parallel behind the middle and the elytra much more than one half longer than the thorax. The antenna is illustrated on plate 67, figure 14 and a portion of the proventriculus on plate 69, figure 8.

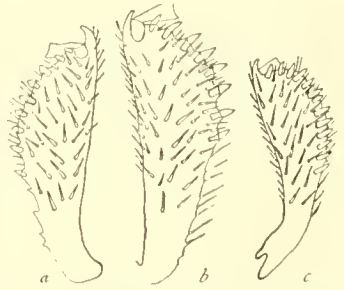


Fig. 103 Middle tibiae: *a*=Xyleborus celsus; *b*=X. dispar; *c*=Chramesus hicoriae, much enlarged (original)

Life history. This is our largest American species of the genus, and according to Mr Hubbard, has been found only in hickory, though Drs Packard and LeConte record it as an

oak-boring species. Their position, however, is not sustained, so far as we have been able to ascertain, by other observers, who almost invariably give its food plant as hickory. Mr Hubbard states that the beetles make a short entrance passage, from the end of which numerous branches radiate in a nearly horizontal plane. These penetrate deeply into the heartwood and greatly hasten decay. The galleries are blackened as in the case of other wood borers, but the stain does not extend far into the wood, indicating that comparatively lifeless trees are attacked by this species. He states that the ambrosia consists of club-shaped stems growing upright in dense clusters. The joints are long and the terminal conidia when they spread are several times longer than wide. The young and adults of the beetles live socially in the galleries, and the pupae lie free in the passages. Hubbard states that the male of this form has been described by LeConte as X. biographus.

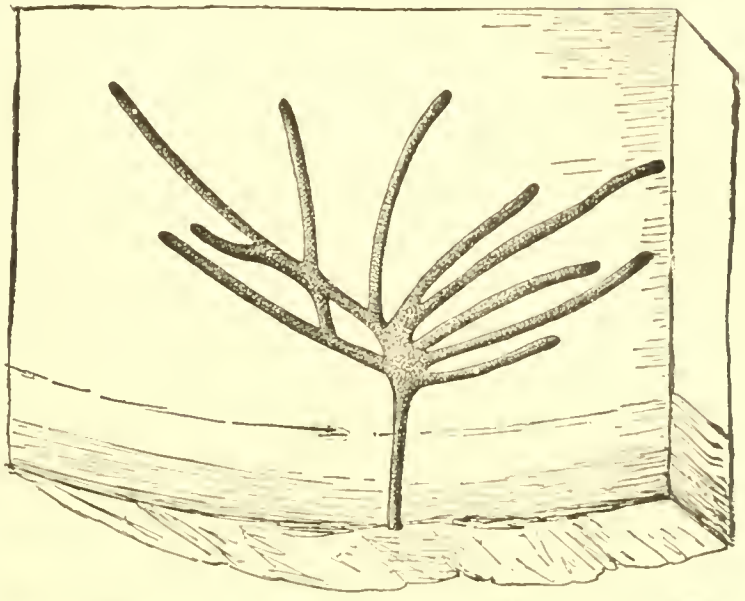


Fig. 104 Gallery of Xyleborus celsus (After Hubbard, U. S. Div. Ent. Bul. 7, n. s. '97)

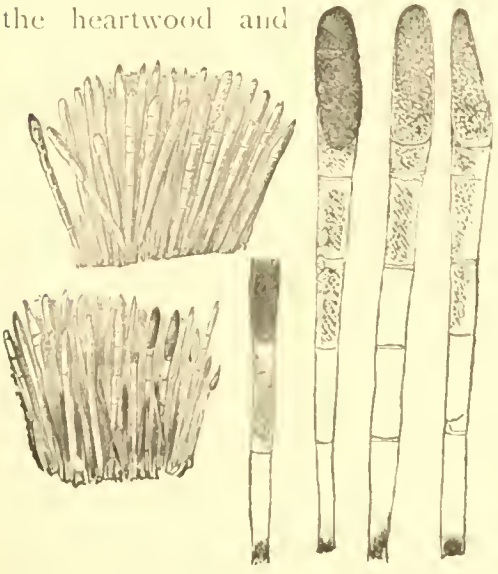


Fig. 105 Ambrosia of Xyleborus celsus (After Hubbard, U. S. Div. Ent. Bul. 7, n. s. '97)

Distribution. This species has been recorded from the Middle and Southern States by Dr LeConte, and it is undoubtedly generally distributed, since it has been listed from the vicinity of Buffalo N. Y., Cincinnati O., southwestern Pennsylvania, New Jersey and the District of Columbia.

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Hickory twig borer

Chramesus hicoriae Lec.

A short, stout, black beetle about 1/16 inch long, may be bred from hickory twigs.

This common species was reared from hickory limbs infested with a gnarly or knotty growth, the adults appearing June 11 and July 1, 1902.

Description. A black or dark brown beetle, rather stout, about 1/16 inch long. Club of antennae large and longer than funicle. Eyes slightly emarginate, coarsely granulate; thorax sparsely clothed with short, yellowish pubescence. Wing covers plainly striated and with a pubescence similar to that of the thorax. The antenna is figured on plate 67, figure 9, a portion of the proventriculus on plate 69, figure 6 and the tibia in figure 103.

The larva has been described by Dr Smith as curculionid in form, pure white, about 1/16 inch in length, and with a brown, chitinous head, usually retracted so as to show only the mandibles, which latter are very stout, curved, with a broad, gougelike, cutting edge.

Life history and habits. This insect is quite common in hickory twigs from 3/5 to 1 inch in diameter, the burrows being mostly in the wood and just scoring the bark. A single upright channel about 1 inch long is cut by the parent beetle, and eggs are deposited at nearly regular intervals on each side, the larvae working at right angles for a short distance and then turning and boring nearly parallel with the wood fibers. Dr John Hamilton states that he reared a few specimens of this beetle from hickory limbs the first summer after cutting, and great numbers during the second season.

Distribution. This species probably has a wide distribution in the eastern United States, since it has been recorded from New York, New Jersey, Ohio, southwestern Pennsylvania, District of Columbia, Louisiana and Minnesota.

Natural enemies. Dr Hopkins has reared Elasmocerus terminatus Say, from wood infested by this species in company with others, and has also obtained Hypophloeus parallelus Melsh. from the galleries of this insect. Dr LeConte has reared Chariessa pilosa Forst. and Phyllobaenus dislocatus Say from hickory limbs infested by this species.

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Chestnut timber worm

Lymexylon sericeum Harr.

A slender, white grub with a conspicuous hump behind the head and a dark brown, obliquely truncate, serrate posterior extremity, makes extensive galleries in the wood of living and dead chestnut and oak.

This destructive borer tunnels the sapwood and heart of chestnut in all directions, though its galleries are frequently oblique and along the lines of growth. Entrance is effected at some wound or where a limb has broken off. Its work in chestnut is so abundant in many sections as to cause material depreciation in the price of otherwise valuable timber. The parent is a slender, chestnut-brown, yellow-haired beetle about $\frac{1}{2}$ inch long. The larva is white, slender, cylindric, about $\frac{3}{4}$ inch long. It has a peculiar hump behind the light yellow head, and a hard, dark brown, excavated, obliquely truncate posterior extremity margined with stout quadrate teeth.

All fallen or dead timber should be removed from the forest as soon as practical, as this species breeds readily in dead trunks. Unnecessary blazing or wounding should be avoided, since such places are very favorable to infestation by this borer.

Callidium aereum Newm.

A brownish, flattened beetle about ½ inch long, occurs on chestnut, the larvae mining the inner bark.

This species appears to be generally distributed in the eastern United States. It has been recorded from New York, New Jersey and the District of Columbia. The larvae mine the inner bark of chestnut, and in the opinion of Dr Hopkins may hasten and perhaps cause the death of aged or injured trees. The adult may be separated from others of its species, according to Wickham, by its color, it being entirely testaceous or brownish, while the related forms, Callidium antennatum Newm. and C. janthinum Lec., are metallic blue or green or buff. This species breeds in chestnut, while the others occur, more commonly at least, in pine and perhaps other coniferous trees. Mr Ulke records this, among other species, as being common on pine. This record evidently refers to places where the adults were captured and does not necessarily imply that the insect breeds in this tree.

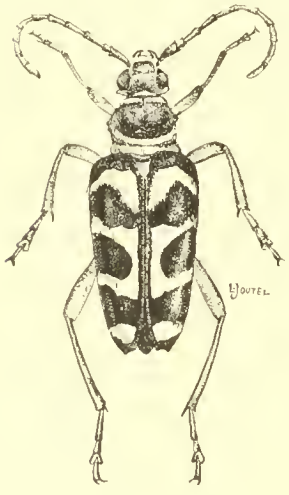


Fig. 106 Leptura zebra, enlarged (original)

Leptura zebra Oliv.

A beautiful, black, golden-marked beetle about ⅝ inch long, occurs on various trees in June.

A single specimen of this handsome insect was cut from living chestnut bark just above where a chip had been taken from a tree at Highland, June 2, 1903.

Description. This species presents brilliant contrasts of golden yellow and black on the thorax and wing covers. The former is margined anteriorly and posteriorly by bright golden yellow; there is a yellow band near the base of the elytra, each half being arcuate; a broad band across the middle of the wing covers is more or less divided into two large, oval, black spots. Underneath, the insect is clothed with yellowish pubescence, thickest on the posterior margins of the abdominal segments. There is a much narrower band near the tip of the elytra. The mouth parts and the legs are yellowish red.

Food plants. This insect has been recorded on several food plants. Dr Smith states that it occurs throughout New Jersey on chestnut, oak and beech, and Mr Beutenmuller gives pine in addition to the above.

Distribution. This species has a wide distribution, occurring in New York, and having been recorded from the vicinity of Buffalo, Cincinnati, southwestern Pennsylvania and the District of Columbia. Dr Hamilton states that it is common in southwestern Pennsylvania, where it breeds in white oak stumps.

Sesia scitula Harris

A blue black clearwing about ¾ inch long, with yellow-banded legs and abdomen, bores in the larval stage under the bark of chestnut and dogwood.

This species is known to occur in Canada, New England, Middle States to Virginia and westward to Ohio and Illinois. It is said to be closely allied to Sesia pyri Harris. It lives in the larval stage under the bark of chestnut and dogwood and also inhabits the gall of Andricus cornigerous. The dogwood, Cornus florida appears to be its favorite food plant. This species was bred July 4 from rough, black, polythalamus galls on limbs of black and red oak by Walsh, and the late Dr Kellicott obtained the same insect from globular swellings on oak twigs in May.

Male. Head and antennae black; palpi yellow, tip black; orbits white. Thorax deep blue black with a yellow line on each side and a yellow patch on each side beneath. Abdomen deep blue black with a narrow yellow ring on the second and fourth segments, the latter covering the whole segment beneath. Anal tuft black. At the base of the abdomen is a yellow line reaching to the end of the second segment. Femora blue black, tibiae yellow with a purple band on the middle and hind femora. Anterior coxae yellow. Forewings transparent, borders and discal mark blue black, narrow; outer margin broad, with yellow rays. Underside brighter than the upper. Hind wings transparent, margins very narrow, blue black.

Female. Similar to the male, but heavier. The palpi are wholly yellow and the fourth segment is yellow above and below; the fifth and sixth are yellow beneath; on the forewings the yellow between the veins of the outer border is more distinct and the anal tuft is yellow at the sides.

Expanse, male and female, 18–22 mm. *Beutenmuller*

Peach bark beetle

Phloeotribus liminaris Harr.

A minute, brownish, rather stout beetle about 1/10 inch long, runs transverse galleries in the inner bark of peach, plum and cherry.

This little species is better known as a pest of fruit trees than a depredator on ornamental or forest trees, though it occasionally attacks wild cherry, probably plum and related trees. Its method of work is very characteristic. The galleries of the adult beetles run transversely or nearly so to the grain of the wood, two diverging from a common entrance chamber. Each is the work of a single female which deposits a great many eggs at close intervals on each side. These hatch and the young grubs proceed to make channels at approximately right angles to those of the parent insect. The larval galleries are easily recognized because of their expanding, somewhat sinuous character. Infested areas are badly riddled by this species, and in many instances the tree soon girdled. The work of this borer is more frequently met with in early spring, though occasionally beetles are taken in the fall. The easiest way to identify the adults is by their work. Occasionally this is impossible and then recourse must be had to structural characters, the peculiar antennae [pl. 66, fig. 1] being the most striking. This little beetle is rather sparsely clothed with a short, yellowish pubescence, and the elytra are coarsely striate with series of almost confluent punctures.

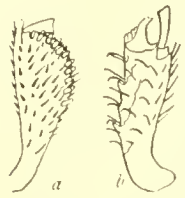


Fig. 107 Middle tibiae: *a* Phloeotribus liminaris; *b* Scolytus rugulosus, enlarged (original)

Remedial measures. There is no practical method of checking this pest, beyond cutting and burning infested trees before the insects have had an opportunity to escape and enter others. Ordinarily its attacks are confined to unhealthy trees.

Fruit tree bark beetle

Scolytus rugulosus Ratz.

A dark brown or black, stout beetle about 1/8 inch long, runs longitudinal galleries under the bark of plum, peach, cherry and apple.

This species is well known as a fruit tree pest and it is mentioned in this connection because it occasionally attacks wild cherry. Infested branches are badly tunneled by the numerous borings of both adults and larvae, resulting in their speedy death. Woodpeckers are very efficient natural enemies and do much toward keeping this species and its allies in check.

Sesia pictipes Gr. & Rob.

A blue black clearwing having a wing spread of about 1 inch and with narrow yellow bands on the abdomen and leg lives as a larva under the bark of plum and several related trees.

The larva of this species lives under the bark of plum, wild and cultivated cherries, beach plum, peach, juneberry (Amelanchier canadensis) and chestnut. It ranges from Canada to Florida and Texas and westward to the Pacific. Its life history has been worked out quite fully by the late Dr James S. Bailey of Albany N. Y., and the following records are taken from his account.

The moths emerge during June and July, the most favorable time for their appearance being between 8 and 10 o'clock in the morning. One cluster of eggs, consisting of 92, was found by Dr Bailey on the under surface of loosened bark within six inches of the root. During rainy days he observed the caterpillars crawling out of the openings and drinking the moisture from the wet surface. Larvae of all sizes from that of a fine pin to those full grown were found beneath the bark of the infested tree. The injured area was perforated with holes made for the exit of the pupa and in other places the bark was cracked and its edges turned outward disclosing the split sapwood beneath. The pupal cells were constructed of fine sawdust, cemented with gum and slightly excavated in the surface of the sapwood. The pupae lay concealed with the head pointing to and in contact with the perforations in the bark.

Dr Bailey observed that the infested tree was visited several times by the hairy woodpecker, Picus villosus, and on each occasion it worked industriously for a considerable time exploring the bark in search of larvae and undoubtedly securing a number.

Male. Head blue black, sometimes with a few yellow hairs between the antennae, palpi pale yellow, black above. Collar at the sides pale yellow. Thorax blue black with a narrow pale yellow line on each side. Abdomen blue black with a very narrow pale yellow ring on the second and fourth segments; the ring on the fourth segment encircles the body, or is only present beneath and sometimes in form of a patch. Anal tuft hastate, blue black, narrowly edged with white at the sides. Legs blue black, with pale yellow tufts on the tibiae, and yellow rings on the tarsi; anterior coxae marked with yellow. Forewings transparent, with the margins very narrow, blue black; discal mark, narrow, straight. Sometimes the inner margin is scaled with pale yellow. Underside with inner and costal margins, and discal mark scaled with pale yellow. Hind wings transparent, no discal mark, and with very narrow outer margin; fringes becoming whitish towards the base. Underside like the upper.

Female. Same as the male, but more robust, with straight anal tuft and simple antennae.

Expanse, male 15–20 mm; female 20–26 mm. *Beutenmuller*

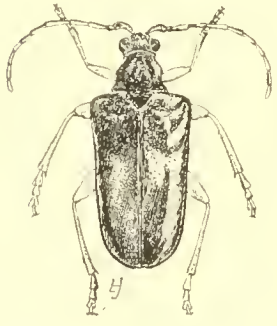


Fig. 108 Gaurotes cyanipennis, enlarged (original)

Gaurotes cyanipennis Say

A red-horned, red-legged, black, brilliant, greenish beetle about ½ inch long, occurs on butternut, oak and birch.

Specimens of this brilliant beetle were taken on birch at Big Moose N. Y., July 2, 1903. This beetle is easily recognized by its striking colors, the head and thorax being black and the wings a brilliant green. The reddish antennae are a little over half the length of the body. The thorax is subcylindric, tapering anteriorly, and the wing covers are slightly truncate.

Life history. Mr Wickham states that he has found this insect largely confined to sumac blossoms in Wisconsin. It has been found pairing and ovipositing on butternut, by Mr F. B. Caulfield, while Dr Hamilton reports it common in southwestern Pennsylvania, where it breeds in Juglans alba.

Distribution. This species probably has a wide distribution in the northeastern United States, since it has been recorded from Arkansas, Kentucky, Cincinnati O., southwestern Pennsylvania, Buffalo N. Y., New Jersey and the District of Columbia.

Goes pulverulentus Hald.

This species appears to present an interesting diversity of food habits in various localities as illustrated by the following records. It occurs in elm about Lowell Mass., as recorded by Blanchard, affects ironwood in the vicinity of New York as stated by Mr Joutel, and local entomologists about New York record it from beech.

Cossonus platalea Say

A flattened, jet-black, snout beetle about $\frac{1}{4}$ inch in length, sometimes occurs in considerable numbers in butternut, poplar and other woods.

This borer was bred in abundance from a section of butternut wood cut the previous year and sent to us by Mr George S. Graves of Newport N. Y. The insects emerged in early April, and with them were also obtained some specimens of Stenoscelis brevis Woll.



Fig. 103. Cossonus platalea, enlarged (after).

This jet-black beetle, about $\frac{1}{4}$ inch long, may be recognized by its somewhat depressed form; short, rather stout beak, and reddish antennae. The head is prolonged into a somewhat expanded beak, which latter is rather coarsely punctured; prothorax smooth, with irregular, large punctures; wing covers deeply striate with series of rather large, separate punctures. It occurs in large numbers under dead butternut bark in September and October and has been bred from butternut wood. This beetle runs numerous irregular galleries which, in the case under observation, were filled with fungus. It has been obtained by Drs Hamilton and Hopkins from under dead white walnut bark, while Dr Smith records it from under partly decayed poplar bark. This species probably inhabits the north-

eastern United States, since it has been listed from Ohio, southwestern Pennsylvania, New Jersey, and it occurs in the edge of the Adirondacks in New York.

Centrodera decolorata Harr.

A slender, light brown beetle about an inch long, bores in butternut and beech.

A single specimen of this uniformly light brown beetle was sent to us by George S. Graves of Newport N. Y., Jan. 5, 1903. It was cut out from a butternut tree, and Mr Wickham states that it has been found by Mr Harrington on beech.

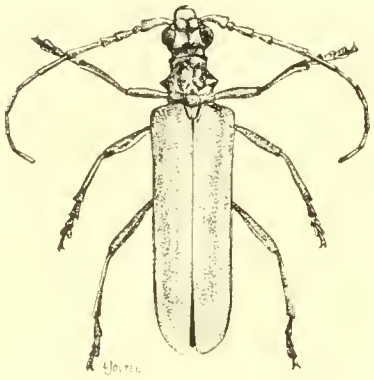


Fig. 110 Centrodera decolorata, enlarged (original)

This beetle is a rather slender insect almost an inch in length. The antennae are rather stout, not quite equal to the body in length, and both they and the legs are a little darker than the wing covers. Head dark reddish with coarsely granulated black eyes; thorax subcylindric, longer than wide, and armed with stout, lateral spines. Wing covers long, slender, closely punctured, and with two indistinct ridges. This species has been listed from New Jersey, District of Columbia and southwestern Pennsylvania, being somewhat rare in the latter two localities.

Sesia corni Hy. Edw.

A purplish black, yellow-marked, red-tailed clearwing moth, with a wing expanse of about ¾ inch, bores in the larval stage in maple.

This interesting form infests the branches and twigs of maple which are often enlarged at several points by rough bark or gnarled excrescences. These are often nearly globular, more frequently, however, oblong and not unusually there are openings into the center of the stem. An examination of the wood shows that it may be mined in various directions and in a decaying condition. The attack often causes branches to die or so weakens them that they are broken by winds. One or more larvae may be found in a single enlargement. Adults are abroad from about the middle of May to the middle of June.

The above observations on the life history are from Dr Kellicott's published account.

This species is known to occur in Massachusetts, New York, Pennsylvania and Ohio.

Male. Head black; palpi orange, orbits white; collar dull orange. Antennae black. Thorax deep purplish black with a very narrow stripe on each side; pale orange beneath. Abdomen slender, deep purplish or blue black with a very narrow ring on the second and last three segments; underside pale yellow. Anal tuft black above, bright red beneath. Legs bluish or purplish black, tibiae and tarsi banded with pale yellow; anterior coxae yellow. Forewings transparent with borders purplish or bluish black; inner margin very narrow; outer margin rather broad. Discal mark large, black. Underside same as above or washed with pale yellow. Hind wings transparent, with very narrow margins. Discal mark small. Underside same as upper.

Female. Like the male, except the anal tuft, which is wholly red, and the antennae have a large white patch on one side before the tip.

Expanse; male and female, 18–21 mm. *Beutenmuller*

Divaricated buprestis

Dicerca divaricata Say

A flat, brassy beetle with divergent wing covers bores as a larva in peach, cherry, beech, maple and other deciduous trees.

This is one of our common flat-headed borers which, as a rule, does not cause much injury though it operates in a large variety of trees.

Description. The beetles have been described by Dr Harris as "copper-colored sometimes brassy above and thickly covered with little punctures; the thorax is slightly furrowed in the middle; the wing covers are marked with numerous fine, irregular, impressed lines and small, oblong, square, elevated, black spots; they taper very much behind, and the long, narrow tips are blunt pointed; the middle of the breast is furrowed; and the males have a little tooth on the underside of the shanks of the intermediate legs. They measure from seven to nine tenths of an inch." The slender tips of the wing covers diverge more or less, affording a character for the ready separation of the species and one from which its specific name is derived.

The larva is one of the familiar flat-headed borers and has been described by Dr Packard as follows:

Prothoracic segment moderately broad, not so long as wide, but not so wide in proportion to the two succeeding segments as in Chrysobothris; the second thoracic segment trapezoidal, narrower than the first by two thirds of its length; third thoracic segment a little narrower and a little longer than the second. All the abdominal segments about two thirds as wide as the third thoracic, and round and thick. The terminal segment a little over one half as wide as the one before it. Prothoracic segment with a large broad rough chitinous surface, with an inverted narrow V with long slender arms to the V. On the underside of the segment, the rough surface is divided into two by two nearly parallel longitudinal smooth lines. Length of body, 35 mm; length of prothoracic segment, 5 mm; breadth, 7 mm; width of metathoracic segment, 5 mm; width of an average abdominal segment, 4 mm.

Life history. The beetles occur abroad during the months of June, July and August, at which time they may be found sunning themselves on the limbs of affected trees. Dr Fitch states that the beech is undoubtedly the original food plant of this insect, and that wherever a dead tree of this species occurs some of the beetles will almost always be found on it on sunny midsummer days.

Food plants. This species breeds in a considerable variety of deciduous trees, having been listed from apple, pear, plum, cherry, peach, beech and maple.

Distribution. This beetle is recorded as abundant from the Middle States by Dr LeConte, and it has been listed from New York, New Jersey, District of Columbia and Ohio by various writers. It is undoubtedly generally distributed and rather abundant in the northeastern United States.

Banded buprestid

Buprestis fasciata Fabr.

A brilliant green, golden yellow, flat beetle about $\frac{5}{8}$ inch long, bores as a larva in maple.

This brilliant green, flattened beetle, ranging from about $\frac{1}{2}$ to $\frac{5}{8}$ inch in length, may be easily recognized by the bright golden yellow markings

on the wing covers. These latter are as follows: A somewhat irregular triangular spot at the basal third of each wing cover, an irregular, angulated, transverse band at the apical third, and a short, oblique, subrectangular spot near the apex. The mark at the basal third is absent in some specimens. This beautiful buprestid bores in maple, according to Mr Hunt. Dr Fletcher has found it abundant on poplars, and it is recorded as rare in New Jersey.



White-horned maple borer

Xyphidria albicornis Harr.

A slender, blackish, wasplike insect about half an inch long and with most of the antennae white, bores as a larva in diseased hard maple in July.

Examples of this interesting species were taken July 4, 1905, at Nassau, on the underside of a dying sugar maple limb, evidently destroyed by a fungous or bacterial affection. The foliage had wilted just a few days before and discolored areas extended through the wood almost the entire length of the limb, the abnormality being more evident at its base. The bark separated readily from the wood and an examination about the places where the insects were found, showed masses of eggs evidently belonging to this species, deposited in peculiar elongate cavities in the inner bark. A favorite spot seemed to be at the very base of the limb, usually near an elevated or rough portion of the bark.

The eggs occurred in irregular masses of a few to about 15, were pure white in color, about 1 mm long, fusiform and with a slender, transparent, flagellate appendage about .75 mm long. The eggs were almost invariably in slight cavities, possibly induced by sap collecting and fermenting in these places. The smaller cavities were very slightly discolored while larger ones apparently varied from dark brown to nearly black. Oviposition was so abundant that 15 to 20 or more of these egg masses were easily found in 10 or 15 minutes work. This species undoubtedly bores in decaying hard maple limbs in much the same way as Xyphidria provancheri Cress.

works in decaying birch and it is probable that the larvae are somewhat similar [*see* p. 466, fig. 116 for an illustration of this latter insect].

Grynocharis quadri-lineatus Melsh.

This black, rather flattened beetle occurs on beech stumps in May. The eyes are medium, rather finely granulated; head somewhat coarsely, and prothorax rather finely punctured, while the wing covers are marked by a number of conspicuous ridges with the interspaces coarsely punctured, almost reticulate.

Xylocleptes species

Dark brown or black beetles, about $^{1}/_{32}$ inch long, make longitudinal burrows in partly decayed sugar maple limbs.

This species was met with by the writer in very small numbers August, 1901 at Axton N. Y., in a dead sugar maple limb. The adult beetles run a somewhat tortuous longitudinal gallery just under the bark and escape, as in the case of most bark borers, through round holes about $^{1}/_{64}$ inch in diameter. A central chamber was detected in one instance and in this case there were two longitudinal galleries proceeding therefrom and slight notches indicated the beginning of two others. Eggs are evidently deposited on either side of the burrow and the young makes somewhat tortuous galleries at approximately right angles to those of the adults. The insects were probably breeding at the time they were collected, as a few larvae were seen but not preserved.

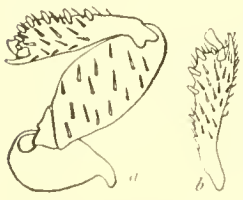


Fig. 112 *a* portion of leg of Xylocleptes sp.; *b*=middle tibia of Pityogenes sp. *a* (p. 374), enlarged (original)



Fig. 113 Xylocleptes work in decaying maple twig (original)

Description. The beetle is less than $^{3}/_{32}$ inch in length, cylindric, rather slender and of a dark brown color except the legs, which are a light brown. The head is well retracted and the black eyes are coarsely granulate. The anterior portion of the prothorax is tuberculate, the dorsal part and the wing covers or elytra are rather sparsely and coarsely punctured.

Prickly leptostylus

Leptostylus aculiferus Say

Small worms similar to young apple borers, sometimes occur in multitudes under the bark, forming long, narrow, winding, gradually expanding tracks on the outer surface of the wood of apple and maple trees.

This species was noticed by Dr Fitch in 1850, who is responsible for the above diagnosis. He states that the beetles appear the last of August.

Description. The adult has been described by Dr Lugger as a brownish gray beetle with "numerous small, thornlike points upon the wing covers and a V-shaped band margined with black a little behind the middle of the elytra. Some well marked and fresh specimens are little beauties, being almost silvery white with dark dots on the band already mentioned. The insect measures a little more than $\frac{1}{3}$ inch in length." Professor Wickham separates this form from its allies by the tubercles on the elytra, each bearing apically, black scalelike hairs, in connection with the feeble and distant puncturing on the elytra, the latter often inconspicuous or concealed. The legs are not hairy and the antennae are scarcely longer than the body, even in the male, the third joint being considerably longer than the fourth. New York specimens are stout, gray-brownish with the prothorax roughly tuberculate, pubescent, with the punctures sparse and irregularly placed. The elytra have raised tubercles or ridges and are ornamented with a grayish and whitish pubescence, which tends to form a postmedian, transverse band broadest at the suture, the pubescence becoming darker anteriorly; tip dark.

Food plants. Dr Hopkins reports it from West Virginia as infesting dead and dying apple and maple trees, and Mr Beutenmuller records it from sweet gum, oak and osage orange. In addition to some of the preceding, Professor Wickham records it from sycamore. Dr Hopkins states that the larvae mine the inner bark of dying and dead tulip trees.

Distribution. This species has been recorded from New York, New Jersey, District of Columbia, West Virginia and Ohio, and probably occurs over an extended portion of the northeastern United States.

Physocnemum brevilineum Say

A rather stout, black beetle about 5/8 inch long and with brownish or bluish purple wing covers ornamented with three whitish lines, occurs on elm in midsummer.

This species is an elm borer in the larval stage and the beetles have been met with on this tree in May, June and July, ovipositing in the latter month. The adult is easily recognized by its rounded thorax and brownish or bluish purple wing covers, each ornamented with three short, slightly oblique, whitish or yellowish lines, one being on the basal third and the other two behind, slightly parallel and near the middle. It is also remarkable because of its dilated femora, those of the hind legs being much the larger.

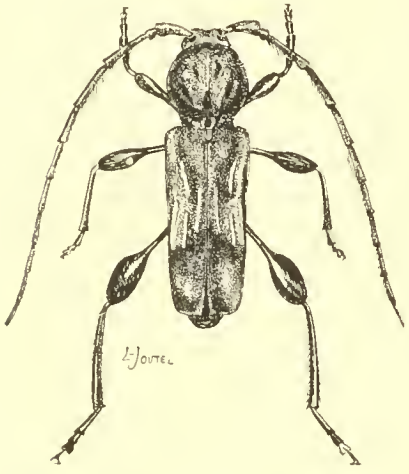


Fig 114 Physocnemum brevilineum, enlarged (original)

Four-marked ash borer

Eburia quadrigeminata Say

The larva of this stout, light brown beetle about 3/4 inch long and bearing at the base and about the middle of each wing cover, pairs of ivorylike, oval elevations, bores in ash, hickory and honey locust.

This handsome borer is easily recognized on account of its light brown color and the conspicuous pairs of ivorylike elevations at the base and middle of each wing cover. The slender, brown antennae are longer than the body and rise between the deeply emarginate eyes. The prothorax is cylindric, with conspicuous lateral tuberosities and a pair of sublateral tubercles just before the middle, and posteriorly a slight median elevation. The wing covers are closely and irregularly punctured, marked by several more or less distinct ridges and each terminated by a pair of conspicuous spines. The larva of this insect bores the trunks of honey locust, hickory and probably ash, and Dr Hopkins reports taking adults in July on dead beech and elm, adding that it probably infests these trees. Dr Smith states that this species is rare throughout New Jersey in July on oak and hickory.

It has also been recorded from West Virginia and the vicinity of Washington, Cincinnati O., and is probably generally distributed in the northeastern United States. Dr Packard, in his account of this insect, cites a case where beetles were bred from an ash sill used in the construction of a house erected some 19 or 20 years before. It hardly seems possible that this insect could have existed during all these years, still there is no occasion for doubting the authenticity of the report.

Obrium rubrum Newm.

Slender, flattened, tortuous galleries in ash, 1/16 to about 1/8 inch in width, cutting the wood largely, are very likely the work of the larva of this species.

This insect is a flattened, reddish or rufous beetle about 1/4 inch in length and remarkable for its long, slender antennae. The thorax is nearly cylindric, with lateral tuberosities and much narrower than the elytra, which are rather coarsely punctured and thickly clothed with yellowish hairs. The thighs are strongly clubbed. This beetle emerges from an exit hole a little over 1/16 inch in diameter.

The full grown larva is about 1/2 inch in length, slender, tapering gradually from the swollen prothoracic segment, and with the body strongly annulate. The mouth parts are inconspicuous and tipped with dark brown. This larva is remarkable on account of the ventral and dorsal callosities or leglike processes on the anterior portion of body segments 6, 7, 8 and 9. The resemblance to prolegs is very striking though superficial, and on the dorsum of the fifth body segment the same structure exists in a much more rudimentary form, though there are no indications of thoracic legs. The work of this borer in ash is represented on plate 38, figure 2.

Distribution. This species is probably widely distributed in the Eastern States at least, though we have records only of its occurring in Ohio, southwestern Pennsylvania and the District of Columbia, aside from its being taken in New York State.

Natural enemies. A parasite, kindly determined by Dr Ashmead as Brachistes phymatodis Ashm., was reared from a log infested by this borer.

Memythrus asilipennis Boisd.

A large, brownish, yellow-marked and yellow-banded clearwing moth, with a wing spread of 1½ inches, bores as a larva in ash and alder.

The ash tree suffers very much in Massachusetts from attacks of this borer, according to Dr Harris. It has been recorded from New Hampshire to Florida, westward to Minnesota and southward to Texas. The species occurs in Buffalo in small numbers. It also attacks alder.

The following account of the habits of this borer is based on observations by Mr W. L. Devereaux of Clyde N. Y. The species is very abundant in that section, being more plentiful in some swamps than in others. It runs its cylindric burrow from the tap root directly up the trunk, sometimes to a height of three or more feet, before turning and cutting its way out. This burrow is never in the center of the tree, but is generally nearer the bark than the heart, and the upright or vertical portion of it is as perfectly made as though cut by a carpenter with bit and brace. Mr Devereaux considers the alder the favorite host plant of this species because ash trees in swamps not containing alder are almost exempt from attack while no clump of alder is without evidences of its work.

Description. *Male.* Head blackish, palpi pale yellowish white beneath, rufous above. Antennae rufous. Collar edged with dull orange brown. Thorax brown, patagia rufous, hind portion with a yellow transverse line. Abdomen dull brown black with a very narrow yellow ring at the posterior edge of each segment above and below. Legs orange, femora black. Fore wings transparent with narrow brown borders and discal mark which is marked with rufous; underside marked with orange brown on the opaque portions of the wings. Hind wings transparent, with a very narrow brown border; underside similar to the upper.

Female. Like the male, but the forewings are opaque, deep brown, violaceous, with an oblique reddish discal mark, and a triangular transparent area above the hind angle. Abdomen like that of the male, but more robust, with the second segment marked with red above. Antennae simple

Expanse, male 30–38 mm; female, 32–44 mm. *Beutenmuller*

Xyphidria provancheri Cress.

The larvae of a sawfly may be found boring in the partly decayed wood of standing white birch trees, making a gallery about ⅛ inch in diameter, the adults emerge from the tree through circular holes of about the same size.

This species was met with Aug. 20, 1900, at Saranac Inn, where the larvae were working in a partly rotten standing birch, and living adults bred therefrom Sep. 6, 1901. A few of the insects had emerged earlier and then died.

Description. The adult sawfly is a jet-black insect, about ⅝ inch long, with a yellowish white mark on the dorsum and one on the posterior lateral corner of the head, one at the base of the wings, one each on the sides of the third to the sixth and the eighth abdominal segments. Those on the head and at the base of the wings are somewhat elongate, broken and angulated in the latter, while those on segments 3 to 6 of the abdomen are subtriangular, and that on the eighth segment is subquadrangular. The mandibles are a deep rufous, tipped with black, and the mouth is bordered anteriorly and laterally with yellowish white. The dorsum of the head and the thorax is rough, tuberculate. The wing spread is about one inch. The male is more slender and a little smaller than the female.



Fig. 11. X[yphi]idria [pro]vancheri, work in birch, showing [ga]llery and exit holes (original).

The larva when taken in August was about ⅝ inch long, of a yellowish white color. The head is a creamy white, with the mouth parts bordered with black. The segmentation is well indicated and the thoracic segments bear somewhat rudimentary legs. The posterior extremity of the body is tipped with a short dark brown spine which rises from a yellowish brown

tubercle. The dorsum of the anal plate is deeply furrowed along the median line.



Fig. 116 Xyphidria provancheri, larva, enlarged (original)

The burrows of this larva are confined very largely to the heartwood of decaying birch, and are invariably filled with the borings, except a short, curved portion through which the adult makes its way to the surface.

This species has been recorded from Canada, White mountains, New Hampshire, and Massachusetts, and Professor Cresson considers it closely allied to X. albicornis Harris.

The writer has succeeded in rearing a number of small parasites from this borer, which were kindly described by Dr Ashmead as Pammegischia xiphydriae.

Slender birch horntail

Konowia attenuata Nort.

A horntail borer making moderately large cylindric burrows in decaying birch, very likely belongs to this species.

This insect has been reared from dead black birch by Mr Patton, who also obtained therefrom a parasite, Rhyssa humida Say, which in all probability preys on this borer in the same way as the lunate long sting, Thalessa lunator Fabr., attacks the pigeon tremex, Tremex columba Linn. This species can hardly be considered of much economic importance, as it appears to infest only decaying birch.

Description. The adult has been described by Mr Norton as follows:

Male. Pale honey yellow; antennae 16 jointed, blackish, two or three basal articles yellowish; a spot inclosing ocelli, tip of mandibles, sides of neck, of meso- and metathorax blackish, tergum irregularly dark, pectus brown piceous; body beneath and legs whitish; wings hyaline, nervures and stigma pale; under wings with two middle cells.

This species has been recorded from Connecticut, New Jersey and Pennsylvania.

Chrysobothris azurea Lec.

A flattened, brilliantly colored, purplish or bluish beetle about ¼ inch long, may be met with in May on birch and other deciduous trees.

This beautiful little insect was bred by us from white birch taken at Karner, Ap. 6, 1903. The specimens emerged May 12. This insect is one of our most brilliantly colored native species, and may be recognized by the three sparkling blue depressions on each purplish wing cover. Underneath, the insect is brilliant green or bluish, with coppery on the sides, particularly of the abdomen. The coloring of this species is somewhat variable, and Dr LeConte states that it may be distinguished from C. harrisii Hentz, by the structure of the antennae. He records this insect from New York, Illinois, District of Columbia, Georgia and Texas, and it has been listed from Ohio by Dury. It is probably widely distributed in the eastern United States, at least.

Bellamira scalaris Say

A slender, brownish beetle, ranging from about ¾ to nearly 1¼ inches in length, bores as a larva under the bark of yellow birch and has been taken ovipositing on maple.

Description. The beetle has been described by Mr Wickham as follows:

The form is slender, the elytra tapering greatly to and rounded at tip, deeply sinuate at sides, the tip of the abdomen uncovered. The prothorax is bell-shaped, with prominent, rather flattened hind angles. Color brownish; most of the head, a greater portion of the fore and middle legs, the bases of the hind femora and the bases and tips of the ventral segments inclining to reddish or even yellowish. Antennae rufous. Elytra brownish, with a large lighter (golden-sericeous) wedge-shaped mark (wavy on the edges and sometimes interrupted at about one third its length by a transverse brownish band) which extends about two thirds to tip. The body is finely and densely in most places rugosely punctured, clothed with fine golden pubescence, which is much denser on certain parts, notably the abdomen.

This insect has been taken in the Adirondacks in August, and Mr Harrington has observed it ovipositing in a maple stump in July. It has also been recorded from New Jersey. Dury records taking a jet black variety of this species in the vicinity of Cincinnati.

Stalk borer

Papaipema nitela Guen.

A brownish, white-striped caterpillar about an inch long, bores commonly in herbaceous stalks and occasionally in the tender twigs of certain trees.

This stalk borer, well known because of its infesting thick herbaceous stems, occasionally works in the younger twigs of maple and ash.

Birch bark borer

Dryocoetes species

A brownish, cylindric beetle, works in the stumps of recently cut yellow birch, causing an excretion of sap which gums the rust-colored borings to the outside of the affected wood.

This species was met with by the writer Aug. 23, 1900, at Axton N. Y., where it was working under the bark of the stump of a recently cut yellow birch. It appeared to be relatively scarce in the Adirondacks in 1900, and was met with but once, though a number of stumps were examined in hopes of finding it. It was taken by Mr Young, July 1903, in recently burned trees at Big Moose and Saranac Inn, at which time it appeared to be common, probably because of the large number of trees offering favorable conditions for its development. The only exterior indication is oozing sap which causes the rust-colored borings to adhere to the entrance of the gallery. The insect works in a very irregular manner under the rough bark. There is usually a central chamber from which several galleries of greater or less lengths may diverge, in almost any direction, and sometimes there is a large excavated area with apparently no plan.



Fig. 117 Work of Dryocoetes sp. in birch, showing entrance and galleries (original)

The parent insect is a brownish, rather stout beetle, about 5/32 inch in length. The black, coarsely granulated eyes are emarginate, the head and thorax are finely punctured and the wing covers ornamented with longitudinal rows of coarsely set punctures. The structure of the tibiae, antennae and proventriculus of this species and the allied Dryocoetes autographus Ratz. is illustrated in figure 118 and on plate 67, figure 17, plate 69, figures 9, 11.

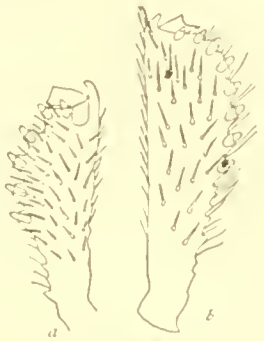


Fig. 118 Middle tibiae: *a*, Dryocoetes sp.; *b*, D. autographus, enlarged (original)

Saperda mutica Say

A small, black beetle with gray or yellowish vestiture is sometimes bred from willow

Very little is known respecting this insect. Beetles were captured by Mr W. H. Harrington on May 15 and June 29, and he states that this species lives in decaying willow. It has been recorded from Canada south to Missouri and westward to Nebraska. It appears to be an uncommon species.

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Sesia albicornis Hy. Edw.

A blue black clearwing moth having a wing spread of 7/8 inch, bores as a larva in willow.

This species lives in the trunks and branches of young willows growing in swampy places. It also breeds in the burrows of the mottled willow borer, Cryptorhynchus lapathi Linn. and in the galls of Saperda concolor Lec. It has been recorded from New York, New Jersey, Pennsylvania, New Hampshire, Illinois, Colorado, California, Nevada and Oregon.

The type of this insect, according to its describer, came from Nevada, though the late Dr Riley, in commenting on this species, states that it was received from Karner [Centre] N. Y. It is recorded as a common species in certain localities. The pupal case is represented on plate 16, figure 15.

Male. Head bronzy black; palpi white, rarely pale yellow. Antennae blue black, rarely with a white patch before the tip. Thorax bronzy black with a very slight, pale yellow stripe on each side, sometimes absent. Underside of thorax with a very pale yellow spot on each side. Abdomen wholly bronzy black. Anal tuft marked with white beneath. Legs blue black; tibiae with white tufts; anterior coxae pure white. Forewings transparent, with violet brown borders; costal and inner margins narrow; outer margin broad, golden yellow between the veins. Discal mark distinct, blue black. Underside scaled with pale yellow. Hind wings transparent with outer margin narrow, violet or blue black. Underside similar to the above.

Female. Wholly bronzy black with violaceous reflections, except the transparent parts of the wings. The legs with bluish reflection and white tufts on the tibiae. Forewings beneath on the costal margin and discal marked with yellow scales. Antennae always with a prominent white patch before the tip.

Expanse, male 15–18 mm; female 18–22 mm. *Beutenmuller*

Sesia bolteri Hy. Edw.

A steel blue clearwing moth with a broad abdominal band and the fore wing tips red, bores willow canes in the larval stage.

The larvae of this species bore in willow canes. It has been recorded from New York, New Jersey, Illinois and Manitoba.

Male. Head and thorax deep steel blue black, orbits pure white; palpi above black, bright orange beneath. Antennae deep steel blue black, with the tip, for one third the length, yellowish on one side. Abdomen deep steel blue black, with the fourth and fifth segments bright scarlet red above and below. Anal tuft blue black tipped with white. Legs blue black, tibiae tufted with white; tarsi pale yellow. Fore wings transparent, costal and inner border narrow, deep black with a steel blue lustre; discal mark straight; outer margin broad and heavily scaled with scarlet or coppery red between the black veins; fringes violet brown. Underside brighter than above, costal and inner margin pale yellow. Hind wings transparent, outer margin very narrow, black, fringes violet brown. Underside same as above.

Female. Larger and more robust than the male. The red on the forewings is usually brighter; the sixth segment is red beneath, and the hind tarsi are bright orange, otherwise same as the male.

Expanse, male and female, 12–20 mm. *Beutenmuller*

Three banded clearwing

Memythrus tricinctus Harris

A black clearwing moth with three conspicuous yellow abdominal bands lives in the larval stage in Saperda galls on willow and poplar.

This borer attacks the small trunks of willows and poplars, and the moth has been bred from the galls of Saperda concolor Lec. It occurs in Canada, New England and the Middle States westward to Ohio and Michigan. Dr D. S. Kellicott, in writing of this insect, states that he took larvae from the branches, suckers and small trunks of the balm of Gilead, Populus candicans, growing on lowlands along the Niagara river below Buffalo. The smaller grubs were sometimes found in the sapwood or just beneath the bark, but the larger ones were generally in the center or pith of the stems. They cause considerable swellings on the small branches, which are frequently as prominent as those made on willow branches by a tortrix larva, which he found very abundant in the same locality. Dr Kellicott was of the opinion that the adult deposited her eggs in the deserted burrows of Saperda moesta Lec., thus permitting the young caterpillars to easily gain access to the wood, its home for at least a year. The Saperda galls become more enlarged by the attacks of this insect.

Description. *Male.* Head black, collar yellow in front and at each side behind; palpi black, yellow inside towards the tip. Antennae blue black above, ferruginous beneath. Thorax black, with a yellow spot at the base of the fore wings and one on each side posteriorly. Abdomen black, with a slight bluish reflection. Second, fourth and last two segments with a yellow band above and below. Anal tuft black. Legs black, middle and hind tibiae partly orange, the latter yellow inside; tarsi orange. Fore wings opaque, violet black with a short transparent streak at the base; inner margin streaked with red at the base, sometimes also along the costa for a short distance; underside yellow at the base. Hind wings transparent, with a narrow outer margin and discal mark violet black, as are also the veins. Underside with discal mark and costal margin orange red or same as above.

Female. Like the male, but with only three yellow bands on the abdomen instead of four, one on each of the second, fourth and sixth segments.

Expanse, male and female, 25–28 mm. *Beutenmuller*

Aegeria tibialis Harris

A large brown, yellow-marked clearwing moth having a wing spread of 1¾ inches lives as a larva in willow and poplar trunks.

This species occurs in Canada, the New England States, New York, British Columbia, Vancouver, Colorado and California, and attacks the trunks of willow and poplar.

Male. Head black, orbits and top lemon yellow, as are also the palpi. Antennae jet-black. Thorax deep brown black, with a very narrow yellow line on each side forming a yellow spot behind and meeting a rather broad curved line on each side in front. Sometimes the two lines on top are very indistinct or almost absent. The lateral line connects with the yellow spot on the base of the fore wings; sometimes the line is broken below the middle. Posterior edge of thorax with black hairs, broadly edged with yellow. Abdomen with first segment black, more or less narrowly edged with yellow behind, second segment wholly black, third segment yellow, narrowly edged with yellow behind, fourth segment wholly brown black, remaining segments brown black, with very narrow yellow bands behind, or yellow with very narrow brown black bands behind. Anal tuft brown black mixed with yellow. Underside of abdomen brown black with yellow bands. Legs yellow, washed with brown. Fore wings transparent with the margins, veins and discal mark orange brown or deep brown black. Hind wings with the borders very narrow, orange brown or brown black.

Female. More robust than the male, with the markings of head, thorax, and wings similar, but as a rule a little more pronounced. Abdomen with the first, second, third and fourth segments as in the male; last three sometimes almost entirely golden yellow, with the tip washed with brown; the fifth and sixth segments are half yellow and brown. Underside yellow, with narrow brown, black bands, except the last or last two segments, which are wholly yellow.

Expanse, male 30–32 mm; female 35–40 mm. *Beutenmuller*

Aegeria apiformis Clerck

A large brown, yellow-marked clearwing moth having a wing spread of 1¾ inches lives as a larva in roots of willow and poplar.

This European species is relatively rare in this country although it has been recorded as far west as Nevada. It attacks the roots and trunk of willows and poplars, requiring two years to attain maturity. The adult is very sluggish in habit and readily captured.

Male. Head and palpi lemon yellow. Antennae black above, ferruginous below. Thorax brown, with a large lemon yellow spot on each side in front, and a similar one on each side of the posterior part. Sometimes the spots are united by a yellow dash along the patagia. Abdomen with a very broad yellow band on the anterior part of each segment, except the last two, which are entirely yellow; posterior parts of segments narrowly brown. Legs yellow, slightly washed with brown. Fore wings transparent, with narrow light brown borders and discal mark. Hind wings transparent, with outer margin very narrow, brown. Discal mark absent.

Female. Much more robust than the male, with the second and fourth abdominal segments usually wholly brown. Otherwise similar to the male.

Expanse, male 30–35 mm; female 40–45 mm. *Beutenmuller*

Acanthoderes decipiens Hald.

A rather stout, blackish beetle irregularly marked with gray, may be taken in June on poplar and hickory.

This insect was met with on poplar at Karner, June 18, 1902, and appears to be a somewhat rare species in this section. Dr J. B. Smith records taking this species in New Jersey on dead hickory in May.

Description. It is a rather stout beetle, about ½ inch long, black, irregularly marked with gray, with annulate antennae about the length of the body. The thorax is wider than long and with a prominent tuberosity on each side. The elytra are nearly truncate anteriorly and bluntly spined posteriorly. This species may be separated from its allies, according to Leng and Hamilton, by the maculate white pubescence on the body; the sutural region is not grooved, the elytra are without a whitish space, each bears a distinct M-shaped, black mark behind the middle, and the base is irregular, with an oblong, obtuse umbone at its middle.



Fig. 119 Acanthoderes decipiens, enlarged (original)

Distribution. This species has been recorded by Messrs Leng and Hamilton from Massachusetts, New York, New Jersey, Pennsylvania, Virginia, Georgia, Louisiana, Nebraska, Ohio, Canada and Maine, and it has been listed from the District of Columbia, by Ulke. It has also been taken by Zesch and Reinecke in the vicinity of Buffalo, and is recorded in Dury's list of Coleoptera, from near Cincinnati O.

Saperda concolor Lec.

Girdling the trunks of sapling poplars or running a mine around them, causing a swelling twice the diameter of the tree, the larva of a cylindric slaty gray beetle 3/8 inch long.

Life history. The insects appear from the last week in May till after the middle of June and select for oviposition the smaller canes of dwarf willow. The beetle gnaws a longitudinal incision through the bark about 3/4 inch in length and deposits an egg in each end. Several are usually made in the same cane some distance apart and these often cause its death the following year. A warty, gnarly swelling occurs around each incision. The young larvae bore nearly to the center of the smaller canes, while the larger ones are from one third to one half girdled, the gallery being marked by a rough, annular swelling.

Distribution. This species ranges from Canada south to Texas and from Massachusetts westward probably to the base of the Rocky mountains, since it has been recorded from New Mexico.

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Saperda populnea Linn.

A small brown or black coarsely punctured beetle about 3/8 inch long may be bred from galls of balsam poplar.

This European species occurs on the Pacific coast and is of interest because it has two varieties, moesta Lec. and tulari Felt & Joutel. The latter variety is western, the former occurs in New York and ranges from Canada to Wyoming south to Pennsylvania. Our form is a small blackish beetle ranging in length from about 3/8 to a little over 1/2 inch, the larger being females. This variety occurs in balsam poplar, and though it has been reported from the vicinity of New York city, this record is probably founded on an erroneous identification, and the species taken about New York city is really S. concolor Lec.

Life history. The beetles occur abroad in June and larvae have also been met with the same month. Its borings cause galls in balm of Gilead branches, the larvae occasionally being very abundant and in some instances not more than an inch or two apart and located chiefly at the base of the buds, where their presence is indicated by a swelling in the branch surmounted by a brown patch of partly decayed bark. The larva makes an excavation more than an inch long, much of which is filled with debris.

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Dorytomus parvicollis Casey

A small, brownish black, yellowish specked weevil about ⅛ inch long, occurs in early spring under poplar bark.

This snout beetle was very abundant under the loose bark of poplars at Karner, up to the middle of May 1902. The insects evidently sought this retreat for shelter, because there were no evidences of borings in their immediate vicinity. The beak is moderately long in the male, longer in the female; the thorax is rounded, rather coarsely punctured; the elytral striae are coarsely punctured, and the wing covers are clothed with a somewhat sparse golden pubescence, frequently present in bunches here and there, giving a spotted appearance. This species has been recorded from Indiana.

Dorytomus vagenotatus Casey

A small snout beetle about ⅛ inch long, irregularly clothed with grayish pubescence occurs under poplar bark in early May.

This species is much smaller than the preceding, and apparently correspondingly scarce, since only four specimens were taken as compared with over one hundred of the former species. This differs from the first not only in size but in the finer sculpturing of the prothorax and the smaller dots of the wing covers, which latter are partially clothed with a grayish instead of golden pubescence. This species was described from Indiana.

Poplar carpenter worm

Cossus centerensis Lint.

Stout, white, naked caterpillars about 1½ inches long, bore in poplar trunks.

This comparatively rare species was first described by Dr Lintner from specimens taken on poplars at Karner, then Centre. It appears to be rather rare, though occasionally it may become quite abundant, as evidenced by our finding many larvae of this species in a badly affected cottonwood tree in Albany. This insect has been taken in the vicinity of New York city, and Dr Smith is of the opinion that it occurs in New Jersey. It has been recorded from the Atlantic States by Dr Dyar, and Dr Fletcher has found it about Ottawa Can.

Description. *Larva.* Head dark brown; mouth parts nearly black; thoracic shield pale yellowish, with a sublateral, oblique darker line on each side, body creamy white. Length about 1¼ inches.

Labium yellowish white, broad at base, sutures brown; spinneret conspicuous, brown, slender; labial palpi very small, 1 segmented and bearing two minute apical setae; maxillary palpi 3 segmented. Mandibles dark brown, apex black, with two inconspicuous teeth; epistoma yellowish brown, tuberculate and bearing a number of stout, short setae; labrum yellowish, smooth. Clypeus dark brown, sutures black. Antennae very short, basal segment yellowish white, apical brownish and bearing a conspicuous seta. Simple eyes few, yellowish brown, with a few setaceous tubercles interspersed. Thoracic shield weakly chitinized, yellowish, with a distinct sublateral, oblique line on either side. Anal shield yellowish, weakly chitinized; body tubercles rudimentary and represented only by sparse hairs, spiracles dark brown. Thoracic legs well developed, claws black, the tip of last segment dark brown. Well developed prolegs on the third to the sixth and last abdominal segments.

The pupa has been described by Dr Bailey as "about 30 mm in length, narrow, brownish black, shining, rugose. The clypeus presents a strong, broad, spinous process, supported at base by lateral projections. On the underside it descends into a wide sulcation terminating in a broad projection. The capital appendages are visible, and here and there arise isolated hairs as in the previous stage. The abdominal segments are provided with teeth over the dorsum, decreasing in size to the stigmatal line. The anal segment is provided with two unequal-sized terminal teeth on each side of the vent."*

This adult has been described by Dr Lintner as follows:

The female, in its appearance, approaches nearer C. quercipe rda Fitch than any other of our species. The collar and thorax are black, edged with gray scales. The abdomen is black above, interspersed with gray scales towards its tip, and more thickly beneath. The primaries are black over rather more than their inner half, with some gray scales a little within the center of the wing; the center portion of the wing beyond the reniform mark is grayish. The wing is traversed by broken, black, transverse lines, of which twenty or more can be counted on the costal margin; three or four of those on the outer portion are more continuous and conspicuous than the others. The fringe is marked with black scales opposite the veins. The secondaries are nearly transparent, darker along their inner margin, showing some faint reticulations, which are more conspicuous beneath. [The type is illustrated on plate 44, figure 1.]

The male strongly resembles the female, instead of presenting the marked contrasting differences found in Prionoxystus robiniae Peck and P. macmurtrei Guer.-Men. Its wings are only a little more projected apically than in the other sex.

Expanse of wings of the pair in my collection, male 2 inches; female 2.5 inches. Length of body, female .95 inch; male 1.2 inch.

Life history. This species has been carefully studied by Dr Bailey, and the following account of its life history is based largely on his published observations. The recently emerged moths are rather sluggish and can be easily captured. They resemble the color of the bark so closely that it requires a very good eye and close observation to find them. After the moths have been abroad a few days, they are wild and more or less mutilated. The females deposit their eggs in clefts near the base of the trunk, one producing over fifty. This species appears every season, and observations seem to indicate that three years are necessary to complete the life cycle. The pupae, as in the case with related species, wriggle partly out of the burrows before disclosing the moths, and these conspicuous empty pupal cases are therefore a very convenient means of detecting the number of moths which should be found about infested trees.

Remedial measures. It is probable that this species could be controlled in the same way as the carpenter worm noticed on pages 79–84. Ordinarily the poplar is of so little value and this insect so rare, that it will be unnecessary to check it.

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Locust twig borer

Ecdytolopha insiticiana Zell.

A pale whitish caterpillar bores the smaller twigs of locust, causing a thickened, irregular growth 1 to 3 inches long.

The work of this species has been observed by us in several localities, though the borer is rarely abundant enough to cause material injury Mr J. G. Jack of the Arnold arboretum, states that the young locusts are very subject to serious injury by this borer.

Description. The full grown larva, according to Professor Comstock, is about half an inch long, yellowish and somewhat darker along the dorsal line. The head is dark brown and the thoracic shield a light honey yellow.

The moth has dark ashy brown fore wings with a large patch of dull pinkish white on the outer part and several small black spots near the middle of this patch. The hind wings are a little lighter than the basal portion of the fore wings; wing spread about ¾ inch.

Life history. The larvae, according to Professor Comstock, become full grown about the first of October and desert the stems through holes cut to the surface, descend to the ground and transform to pupae among the dried curled leaves in which they spin thin, tough silken cocoons. One moth emerged October 17 and others from the 20th to the 27th.

Distribution. This species apparently has a wide distribution, as it has been recorded from as far west as Colorado.

Remedial measures. The most effective method of checking this species is to cut off and burn the infested twigs any time before October.

Woodbine borer

Saperda puncticollis Say

A bright yellow-marked, jet-black beetle, almost ½ inch long, may be bred from woodbine, sumac and possibly poison ivy.

This is one of the smallest and prettiest species belonging to this important genus. It is a rare form in most collections in spite of the fact that the insect lives in the dead branches of the common Virginia creeper.

Life history. The beetle is shy, rarely seen, and though it may occa-

sionally be taken on the foliage of its food plant, specimens are more easily obtained by rearing from infested twigs. The adults occur abroad in June and July. The larvae or grubs feed on the inner bark of the branches and stems of the Virginia creeper. Its method of work is represented on plate 6, figures 17–19.

Food plants. It occurs on woodbine and has been recorded from poison ivy and sumac.

Description. This little black beetle may be easily recognized by its golden thorax with four dots and a wide golden margin, including a sutural and marginal stripe on the wing covers [pl. 6, fig. 24].

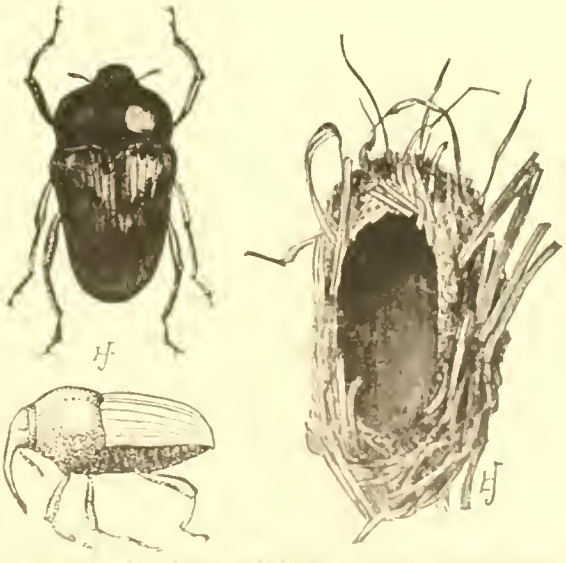
Distribution. This species ranges from Canada south to Louisiana and west to Kansas and Nebraska. It is probably generally distributed in the eastern and middle United States.

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Madarellus undulatus Say

A jet-black, highly polished curculio about ⅛ inch long and with deeply striated wing covers, occurs on Virginia creeper, poison ivy and grape.



This little species is widely distributed, having been recorded by LeConte from Massachusetts to Alabama, Texas and Kansas. The northern beetles are entirely black, while those from the south and west have the prothorax red. Dr Hamilton records two varieties as occurring in southwestern Pennsylvania. This species bores woodbine in association with Saperda punctico llis Say and transforms to the adult in an oval pupal cell composed of finely comminuted, partly decayed pieces of bark and wood glued together.

Alder borer

Saperda obliqua Say

Irregular, gall-like swellings at the base of alder stems, followed by dying and breaking of the shoots, are very characteristic of this insect.

The white-footed, legless grub closely resembles that of the appletree borer and is most easily recognized by the food plant it inhabits.

The adult is a light reddish brown with darker oblique bands on the wing covers. The thorax has a pair of broad, dark brown bands which extend backward onto the base of the wing covers. The spaces occupied by the darker bands on the elytra are depressed, an instance of where coloration is emphasized by sculpture.

Life history and habits. This species is a common one in the State of New York, if one may judge from the numerous dead shoots in alder swamps killed by this species. The beetle oviposits close to the ground in black alder and the larvae frequently girdle the stems, there sometimes being two or three borers near together, one of which is very apt to work downward three or four inches and often below the surface of the ground; the others usually tunnel in an opposite direction. The general method of work is very similar to that of the common round-headed appletree borer, and the beetle emerges from a circular hole very closely resembling that made by the above mentioned species. The adult may be found near the top of alder shoots, and according to Mr Fred. Knab of Chicopee Mass., easily escapes notice on account of its close resemblance to a withered leaflet, and its remaining perfectly motionless, clinging tightly to a branch, with the antennae extended forward. This species has also been taken on birch.

Distribution. This species has been recorded from Canada south to Mississippi and westward to Wisconsin. It is probably generally distributed in the northeastern United States.

Natural enemies. Native woodpeckers appear to be very efficient in checking this borer, as we have found a number of infested stems showing the characteristic marks of these beneficial birds. The larvae are also

destroyed by an unknown Tachinid parasite and another small dipterous larva is sometimes found feeding in considerable numbers on the larva or pupa.

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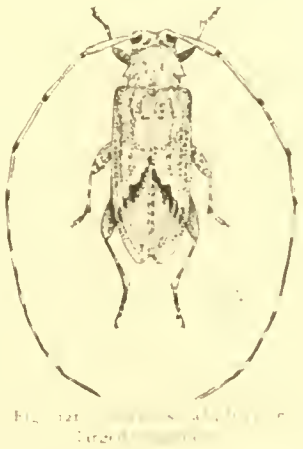
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Liopus alpha Say

A small, legless grub boring irregularly in dead sumac and other twigs, may be the young of this beetle.

This species occurs rather abundantly in dead sumac twigs at Clinton Heights. The infested twigs were gathered and many of the beetles bred therefrom the latter part of May.

The beetle is about $^1/_4$ inch long, rather stout, and remarkable for the long, delicate antennae, which have the enlarged distal portion of each joint dark brown or nearly black. It is rather prettily marked with silvery gray, light and dark brown, the irregular oblique stripe just behind the middle of each wing cover being the most conspicuous, the two forming a V with its point toward the head. According to Messrs Leng and Hamilton, this species is quite variable and difficult to separate from allied forms. They describe five variations in markings and state that it may be separated from its ally, L. cinereus Lec., by the finely punctured surface, behind the band almost impunctured.



The full grown larvae are about $^1/_2$ inch long, and present no unusual characters. Unfortunately specimens were not preserved and a detailed description is impossible.

The working of this larva is limited very largely to the central portion of the twig, and the gallery of one borer may have a length of 2 or 3 inches. The exit hole is oval and a little over $^1/_4$ inch in diameter.

Distribution. Say states that this species is not rare in Pennsylvania and that he has obtained it from the Northwest Territory, and LeConte

records it from the Middle and Southern States, while Schwarz found it abundant at Biscayne bay, Florida. Dr Smith states that it occurs commonly throughout New Jersey, and we have met it in the vicinity of Albany. It has also been reported from Newport and Buffalo.

Food plants. We have reared this insect in numbers from sumac, while Dr Smith states that it occurs on sumac berries of the previous year. Mr Beutenmuller records apple as a food plant in addition to that given above, while Dr Hopkins states that it infests yellow locust twigs on dead trees in West Virginia.

Natural enemies. A single parasite was reared from infested twigs, presumably from this species. It has been kindly determined by Dr Ashmead as Temelucha fusiformis Prov.

Pityogenes consimilis Lec.

A minute, dark brown or black, cylindric beetle about 1/32 inch long, makes the familiar oblique galleries under the bark of decaying sumac twigs, grooving the wood in a very characteristic fashion.

The work of this species is exceedingly common, easily recognized and of little importance except when the carved branches are sometimes employed in rustic structures.

Spotted leptostylus

Leptostylus macula Say

A small, thick, long-horned, brown or chestnut-colored beetle, about 1/4 inch long, with ash gray markings, may be bred from the dead twigs and wood of a number of trees.

This is one of our common borers having very similar habits to its ally, Liopus alpha Say. It breeds in a wide variety of twigs, having been taken from sumac, witch-hazel, chestnut, oak, walnut and apple. Dr Fitch states that old butternut trees are sometimes filled with the grubs of this little beetle.

BORERS IN DRIED USUALLY MANUFACTURED WOOD

White marked powder-post beetle

Lyctus parallelopipedus Melsh.

Pin holes less than 1/16 inch in diameter and galleries of the same size running in various directions in wood, may contain linear, black, white marked beetles about 3/16 inch long.

This powder-post beetle has very similar habits to those of the more common species, Lyctus unipunctatus Herbst., though it appears to be much rarer. Its destructive work was brought to our attention in July 1903, on the reception of a piece of ash from a large furniture manufacturer of New York city, accompanied by the statement that the insects were causing considerable damage to rough stock on hand and had also bred out in numbers from manufactured products, to their great detriment. The piece of ash was badly tunneled by the galleries of this insect and practically worthless for furniture purposes.

Description. The beetle is a jet black or dark brown, linear insect about 3/16 inch long and easily distinguished from the common powder-post beetle, Lyctus unipunctatus Herbst., by the broad, creamy white band near the middle of the wing covers and extending almost to the suture. The head and prothorax are rather coarsely and irregularly punctured, while the wing covers are ornamented with rows of closely set, coarse punctures. The young or larvae are small, six legged, yellowish white grubs with the tip of the body curved.

The work of this species, like that of the common powder-post beetle, is characterized by fine sawdust dropping from the infested lumber.

Life history. This species evidently breeds freely in ash. It has been recorded in fig and probably infests other dry hard woods. The beneficial clerid, Elasmocerus terminatus Say, was bred from the ash board infested with this species and is undoubtedly of considerable service in preying upon this wood borer.

Remedies. Measures of value against the powder-post beetle should be of equal service in checking this species.

Large carpenter bee

Xylocopa virginica Drury

Burrows about ½ an inch long may occasionally be observed in telegraph poles, doorposts and similar places, and large-bodied, dusky winged bees seen going in and out.

This common insect is sometimes very persistent in its efforts to tunnel posts or timbers about houses. It is about the size, and has the general appearance of a bumblebee. The abdomen, however, is jet-black and frequently somewhat bare. The tunnels are excavated in solid wood, sometimes to a distance of a foot and are used as nesting places. A unique example of this insect's work together with the bee is represented at plate 39, figure 3. This shows the outside appearance of a ⅝ inch board, from a weatherworn building, and near the top a small entrance hole ⅜ inch in diameter. The board has been split and the inner aspect with the three long nearly parallel ½ inch burrows, split when the board was sawed in two, is represented in the foreground. The slight enlargements seen along the course of the galleries indicate the location of individual cells. These are separated from each other when filled by chips of wood securely cemented together. The nature of the partition is easily seen from below. The cells are provisioned with a paste of pollen or nectar, and when the young insects mature, those in the lower chambers are obliged to await the exit of the bees in the upper cells.

INHABITANTS OF DECAYING WOOD OR RESIDENTS UNDER DEAD OR DECAYING BARK

A considerable number of species occur in such places. They are of comparatively slight economic importance, yet should be characterized because of the liability of their being mistaken for more destructive species, and to aid in this identification the following brief accounts of some of the more common species are given.

Owl beetle

Alaus oculatus Linn.

A large, rather stout, black, white marked beetle, 1½ inches long, bearing two conspicuous eyelike spots, is frequently met with in decaying wood.

There are a number of insects brought to the attention of the entomologists from year to year on account of some peculiarity and such is the case with this species. Its conspicuous eyelike spots on the prothorax excite the attention of even the most casual observer, and as the beetle is not very common, most specimens observed are captured, and are very likely to find their way into the hands of some entomologist.

This species cannot be considered injurious, since it occurs only in decaying wood, and the observations of Dr Lugger would seem to indicate that it can be classed among our beneficial species. He has found in his own experience that it was impossible to rear the larvae or grubs, unless they were provided with living insects which they soon found and devoured.

Description. This large snapping beetle may be easily recognized by reference to plate 30, figure 2, which shows it about natural size and represents the appearance of a well marked individual. The conspicuous eyelike spots are found only in one other native beetle, a very rare species. This insect is representative of a very large family, members of which possess the power of projecting themselves upward suddenly by the means of a peculiar springing apparatus on the ventral surface. A stout spine on the thorax projects back in a socket in the abdomen and by bending its body backwards, the beetle can raise its spine and rest it on the edge of the socket, and then with a sudden muscular exertion, spring it back into the cavity. The result is that the beetle is thrown into the air to a hight several times its length. This device is apparently for no other purpose than to enable the insect to regain its feet, evidently very useful, since this beetle and its allies are nearly helpless whenever they fall on their back. This peculiar snapping has led to these insects being called snapping or click beetles, and the entire family, which is composed of a large number of forms, are known to scientists as Elateridae.

The large grubs of this giant snapping beetle have been described by Dr Harris as about 2½ inches long, nearly ½ inch in breadth, flattened, reddish yellow in color. It is frequently found in decaying appletree wood.

Broad-necked prionus

Prionus laticollis Drury

A thick, fleshy, legless grub about 3 inches long when full grown bores in the roots and stumps of a number of trees.

This is a very common insect in New York State, though it rarely causes much damage so far as known, for all that the grubs are capable of doing considerable mischief. As a rule we believe their depredations are confined very largely to comparatively valueless forest trees, and therefore this insect is not often brought to the attention of economic entomologists. The operations of this grub being very largely under ground, also enable it to escape notice. The adult beetle is one of the largest native forms, measuring about 1½ inches in length and ⅝ inch or more in breadth. It varies from brown to very dark brown or black. The powerful mandibles are very conspicuous with sharp, cutting edges. The antennae are about half as long as the body. The head is minutely and irregularly punctured, the dorsum of the thorax smooth, the lateral portions being punctured and the edges prolonged into two or three prominent teeth. The wing covers are coarsely rugose with several more or less distinct ridges and are usually decidedly broader at the base. The larva of this insect has been recorded as infesting pine stumps, roots of living black oak, oak logs, roots of linden, poplar, oak, chestnut, apple, pine and grapevine. Dr Riley records a case where this species was very destructive to young appletrees in Kentucky. These borers as a rule work within the roots, though Dr Riley states of an allied species, P. imbricornis Linn., that where the root is too small to accommodate the borer, it eats away about one third of the bark and hollows out the remainder of the root, thus causing great injury in nurseries The adults are abroad during midsummer.

Remedial measures. Since the larva of this species works in the roots, it is very difficult to check its operations and there is nothing better than

destroying the infested trees and avoiding so far as possible conditions favorable to the breeding of this borer; namely, a great many stumps and dead trees in which it can thrive.

Lesser prionus

Orthosoma brunneum Forst.

A rather slender, brown beetle about 1½ inches long and less than ½ inch broad, lives in the larval stage in decaying trees.

This beetle is another rather common species frequently met with in midsummer and attracts notice largely on account of its size. Its larva lives almost entirely in decaying wood, and as a consequence this form is of comparatively slight economic importance. The adult beetle is about 1½ inches long with powerful mandibles, and tapering antennae a little over one half the body length. The large eyes are comparatively inconspicuous, finely granulate, and the thorax is prolonged laterally into a series of two or more irregular teeth. The wing covers are very long, rather slender, with parallel sides, irregularly and finely punctured and ornamented with several rather prominent ridges. The larva of this species has been recorded as boring in decaying pine, hemlock, hickory, walnut, oak, chestnut, and Dr Hopkins states that it inhabits the decaying logs and stumps of nearly all forest trees.

Description. The larva and pupa have been described by Dr Packard as follows:

Larva. Described while alive. Body cylindrical, not flattened, the segments very distinct, as the sutures are deeper than usual; head moderately broad; prothorax large and broad and rather long, being 9 mm broad and 4½ mm long; surface rough on the posterior two thirds. On each of the first to seventh abdominal segments is a transverse oval cylindrical fleshy area, each with three transverse folds, the area on the seventh ring being nearly twice as long (antero-posteriorly) as that on the first, the areas becoming longer and narrower, i. e. more rounded, going backward towards the seventh segment; the end of the abdomen smooth and shining; each thoracic segment with a pair of slender three-jointed feet. Length, 35 mm (1⅜ inches).

Pupae. Antennae bent near their end at right angles and laid across the end of the elytra, the latter reaching to the middle of the hind tarsi.

End of the abdomen terminates in a singular rufflelike expansion, armed on the edges with stout spines. Hind tarsi reaching to the middle of the fifth abdominal segment. The body considerably curved. Maxillary palpi extended well beyond the end of the mandibles. Prothorax with a broad-based spine on the side. The projecting parts of the abdominal segments with fine spines, and segments 3 to 5 with a pair of transverse, thin, dark brown chitinous patches. Length 30 mm.

Anthophilax attenuatus Hald.

An olive gray, mottled beetle with black head and thorax, and about 5/8 inch long, occurs in early spring on partly decayed beech stumps.

This Lepturid has the characteristic form of this subfamily, and has been taken in early May on dead or decayed beech at Newport N. Y. by Mr D. B. Young. The beetles were observed by him, ovipositing in the galleries made by Ptilinus ruficornis, and the process has been described by him as follows:

The beetle crawled along with an odd jerky motion and carefully examined every hole and crevice which it crossed. The crevices were abandoned almost immediately; the galleries were examined with more care and evidently those selected were a year old; the beetles invariably oviposited with the head turned nearly or wholly down. One of the galleries removed after the beetle had oviposited and flown contained 16 eggs. Nothing had been placed in the gallery to prevent parasites from entering. The eggs were placed 1/2 inch from the outside in four lots of four each, with their ends slightly tapering, just filling the diameter of the gallery. The eggs were cylindrical, rounded at both ends, polished, and waxy white; they were gummed together with a yellowish secretion, and were 1 1/2 to nearly 2 mm in length.

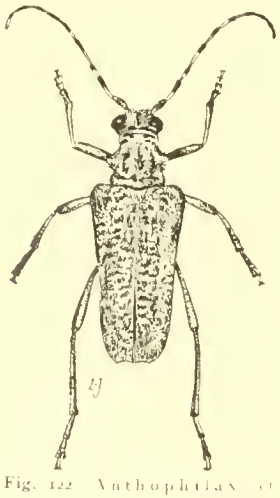


Fig. 122 Anthophilax attenuatus, enlarged (original)

Beetle. Length 5/8 inch; antennae, legs and wing covers olive, mottled with grayish white; head and thorax black and clothed with a short, sparse golden pubescence. This form may be recognized, according to Mr Wickham, by its elytra being testaceous and irregularly marked with piceous spots. The surface is coarsely and sparsely punctate and with small spaces which are distinctly pubescent. Median line of thorax distinctly impressed.

This species was found on the shores of Lake Superior by Dr LeConte, is reported from Ottawa Can., by Mr Harrington, and Dr Hamilton states that it is rare in southwestern Pennsylvania. It has also been listed from Mt Washington, by Mrs Slosson.

Dermestes pulcher Lec.

A brown-headed, black-winged, rather stout beetle about $\frac{1}{4}$ inch long, was bred from larvae taken from a hollow oak.

This species, according to Jayne, may be easily recognized by its general red color and almost entirely black wing covers, the flattened thorax with two basal foveae, and the absence of abdominal spots and white rings on the femora. He records this species from the Southern, Middle and Western States. It must be rare in southwestern Pennsylvania, since Dr Hamilton met with only two specimens. It has been listed also from the vicinity of Buffalo N. Y. and Cincinnati O.

Ditoma quadriguttata Say. This minute, black and reddish beetle occurs in early spring under dead bark of beech stumps. It is about $\frac{3}{32}$ inch long. Head and thorax almost entirely black, coarsely punctured with conspicuous lateral ridges on the latter. The wing covers have an oblique, reddish stripe at the base of the wings, a similar spot near the middle and a smaller one at the posterior third. These organs are conspicuously striated and with coarse, distinct punctures between the ridges.

Mycetochares binotata Say. This species occurs under poplar bark.

Cerylon castaneum Say. This minute, reddish, rather flattened beetle occurs under dead bark of maple stumps in early spring. It is about $\frac{1}{16}$ inch long, the head somewhat rounded, the thorax rather irregularly punctured and the wing covers finely striate with series of confluent punctures.

Silvanus imbellis Lec. This minute, slender, grayish brown beetle occurs sparingly under the dead bark of beech and maple in early spring. It is about $\frac{1}{8}$ inch long, slender, the head and thorax grayish, rather thickly and irregularly punctured; the wing covers distinctly striate with a series of nearly confluent punctures.

Catogenus rufus Fabr. This dark, reddish, somewhat flattened beetle has been taken under dead elm bark in May. It is nearly $\frac{1}{2}$ inch long with conspicuous moniliform antennae. The head and thorax are finely and irregularly punctured and the wing covers marked by a series of deep grooves and with the humeral angles continued as a conspicuous ridge their entire length; costal margin strongly sinuate.

Cucujus clavipes Fabr. This flattened, bright or dark reddish beetle

occurs in early spring under dead elm bark. It is about ½ inch long with conspicuous blackish moniliform antennae, the head and thorax are strongly flattened, irregularly and coarsely punctured, the latter with a series of minute denticulations along its lateral margins; wing covers finely punctured and apparently hollowed. The humeral angles are continued as conspicuous ridges along their entire length.

Laemophloeus biguttatus Say. This small, flattened beetle may be found under dead maple bark in April and May. It is about $\frac{1}{8}$ inch long, the head and thorax are finely though irregularly punctured, mostly dark brown, while the wing covers are finely striate with series of confluent punctures and are mostly dark brown with a middle, somewhat broken band of pale yellowish

Laemophloeus testaceus Fabr. This minute, slender, flattened beetle is not uncommon under the dead bark of maple and beech stumps in early spring. It is about $\frac{3}{32}$ inch long, the slender antennae are nearly as long as the body. The brown head and thorax are rather finely and sparsely punctured, the latter with distinct sublateral ridges and with the lateral margins prolonged, toothed posteriorly; wing covers finely striate with series of minute punctures; lateral margins produced.

Dendrophagus cygnaei Mann. This flattened, brownish species occurs under elm bark in March and April. The dark brown head and thorax are ornamented with irregular, coarse punctures and the brown wing covers are striated with series of rather large, almost confluent punctures; humeral angle pronounced and continued as a distinct ridge along the entire length of the wing covers. The legs are light brown with strongly swollen femora.

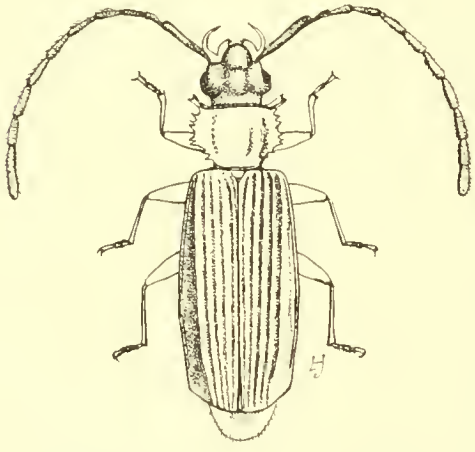


Fig. 125. Uliota dubius, male, enlarged (original)

Uliota dubius Fabr. This flattened, brownish or black beetle occurs under dead elm, beech, maple and butternut bark in early spring. It is about $\frac{1}{4}$ inch long, dark brown or blackish. The reddish brown antennae are as long as the body, and just anteriorly there is on each side a conspicuous curved, hornlike process apparently peculiar to the male. The dark brown head is coarsely punctured with two deeply impressed lines; the prothorax is also coarsely punctured, with lateral margins serrate, the anterior angles being prolonged into conspicuous processes. The wing covers are coarsely striate with a conspicuous humeral ridge their entire length and the interspaces ornamented with numerous confluent coarse punctures.

Ephistemus apicalis Lec. This is a very minute, shining black species which occurs under beech bark in February. It is so very small that a hand lens is necessary to distinguish it from mites found in similar places.

Hister lecontei Mars. A small, stout, flattened, jet-black beetle occurs under the dead bark of such trees as beech, maple, elm, pine etc. frequently in association with various bark borers. The head is minute, partially retracted under the expanded portions of the prothorax. The short, highly polished wing covers are marked with several distinct striae.

Hister parallelus Say

Jet-black, somewhat elongated, subcylindric beetles, about ¼ inch long, may be met with in considerable numbers under the bark of white elm and other trees.

This species was abundant under decaying elm bark at Albany, Nov. 3, 1903, and we have also met with it under spruce bark at Davis W. Va., associated with a species of Pityophthorus. Dr Hamilton records the same species as common under pine bark in southwestern Pennsylvania, and Dr Smith finds it not rare under bark in New Jersey, and states that in one instance specimens were feeding on sap. This species is not a borer, and like its close relatives, is frequently found in the galleries of various wood borers, where it probably feeds on partially decaying or decayed vegetable matter. This species has been recorded from eastern Florida by its describer and, in addition to above named localities, has been listed by Ulke from the District of Columbia and Dr Horn records it from South Carolina and Georgia.

Plegaderus transversus Say. This stout, roundish, dark brown beetle less than 1/16 inch in length, occurs in early spring in damp situations under basswood bark and probably frequents other trees presenting similar conditions.

Colastus truncatus Rand. This small, oval beetle is plentiful in early spring under the bark of freshly cut maple and butternut stumps, where it feeds on the sap. It is about 3/32 inch in length, oval, reddish brown, with the wing covers protecting only the anterior two thirds of the body.

Cryptarcha concinna Melsh. This species is abundant in early spring under the bark of freshly cut maple and butternut stumps, apparently feeding on the sap. It is a minute, oblong, banded beetle about 3/32 inch long, with the thorax and wing covers obscurely marked with dark brown and pale yellow.

Tenebrioides corticalis Melsh. This black, somewhat flattened beetle from 1/4 to 3/8 inch in length, is common under the bark of elm, willow and other trees. The head and thorax are rather coarsely punctured and the wing covers are finely striate with series of small distinct punctures.

Tenebrioides castanea Melsh. This flattened, dark brown beetle occurs in considerable numbers under the dead bark of beech, pine and probably other trees. It is about 3/8 inch long, dark brown, the head and prothorax somewhat coarsely though sparsely punctured and the wing covers weakly striate with rows of shallow, nearly confluent punctures.

Nyctobates pennsylvanica DeG. This large, rather stout, jet-black beetle tapers slightly anteriorly and is about 7/8 inch in length. It is found under dead bark of various trees such as beech, hemlock and birch. The head and prothorax are rather finely punctured and the wing covers are ornamented with a series of minute striae composed of small distinct punctures with the intermediate spaces marked by almost microscopic punctulations.

Iphthimus opacus Lec. This dull black, coarsely punctured beetle about 3/4 inch long, occurs under the decaying bark of various trees.

Tharops ruficornis Say. This insect has been taken from dead beech.

Elater nigricollis Herbst. This species has been found under decaying basswood, beech and maple bark.

Elater humeralis Lec. This beetle may be taken in decaying beech or maple stumps in March, April and May.

Melanotus communis Gyll. This species occurs under the decaying bark of various trees, being perhaps more numerous under that of pine than any other.

Corymbites sulcicollis Say. This species occurs under dead birch bark in March and April.

Dorcas parallelus Say. Larvae of this brownish beetle live in decaying logs or stumps of various trees. We have taken it on elm.

Ceruchus piceus Web. The larvae of this species have been recorded from old beech stumps, decaying chestnut, willow and birch. We have taken it abundantly in rotting black cherry.

Horned passalus. Passalus cornutus Fabr. This very striking, large mahogany brown beetle with its coarsely striate wing covers and deep, broad constriction at the base of the wing covers, lives in the larval stage in the decaying stumps of basswood, hickory and other deciduous trees.

Rough flower beetle. Osmoderma scabra Beauv. This stout, brownish, purplish black beetle about 1 inch long and over 1/2 inch in breadth, with its wing covers roughened by irregular coarsely punctured striae, occurs about decaying portions of various trees. Its larva is very similar to that of the well known white grub, only larger.

Hermit flower beetle. Osmoderma eremicola Knoch. This flower beetle is slightly larger than the preceding, of a dark mahogany color, with smooth, highly polished wing covers. It presumably has the same habits as the preceding form.

Stenosphenus notatus Oliv. This insect was taken at Poughkeepsie on dead hickory and oak. It has been recorded as breeding in dead limbs of the former.

Lepturges symmetricus Hald. This species was taken in early July on beech injured by fire.

Oberea schaumii Lec. This species bores in the twigs and branches of poplar, beetles appearing in early May.

Oberea ocellata Hald. This small longicorn has been reared from sumac.

Scotobates calcaratus Fabr. This large, black beetle about 5/8 inch in length, occurs under the dead bark of various hard woods. The head and thorax are rather finely, irregularly punctured and the wing covers marked with conspicuous striae composed of fine and in many cases confluent punctures.

Tenebrio tenebrioides Beauv. This large, brownish black species occurs under decaying willow, butternut and basswood bark in early spring. It is about ½ inch long, rather stout, the head and thorax are finely and irregularly punctured, while the wing covers are ornamented by series of striae composed of thickly set though distinct punctures.

Penthe obliquata Fabr. This species is very similar to the preceding and like it, occurs under dead beech bark, particularly on trees that are down, and may be distinguished from the following by the yellowish scutellum and from the preceding by the deeply impressed thorax and the coarsely punctured elytra. It is also a somewhat stouter form.

Penthe pimelia Fabr. This stout, black species occurs under dead beech bark, most frequently on trees that are down. The head and thorax are coarsely punctured, the latter with a deeply impressed spot posteriorly. The wing covers are coarsely marked with irregular series of deep punctures.

Melandrya striata Say. This large, black beetle occurs under the dead bark of beech, maple and probably of other trees in July. The beetles range in length from 7/16 to about 5/8 inch and may be recognized by the very finely punctured head and thorax, the latter tapering strongly anteriorly, and specially by the prominently ridged, slightly pubescent, finely punctured wing covers.

Phloeotrya liturata Lec. This black or dark brown, yellow-marked melandryid is about 5/16 inch long and occurs under dead maple bark the latter part of June and July. It may be recognized by the rather peculiar irregular black mark on each side of the anterior third of the elytra

and a smaller one about the posterior third, which latter extends almost to the suture.

Phloeotrya simulator Newm. This species occurs in rotting beech and maple stumps.

Asclera puncticollis Say. This dull black beetle, 5/16 inch long, with a dull red and black-spotted pronotum was taken in midwinter at Newport N. Y., from the dead tissues of a birch, by Mr D. B. Young.

Dendroides canadensis Latr. This species has been taken under the decaying bark of oak, birch, maple, beech and other deciduous trees.

Dendroides concolor Newm. This species has been taken under the decaying bark of oak, maple, beech, birch and other deciduous trees.

Cryptorhynchus parochus Herbst. The larvae of this species have been taken under butternut bark, adults being found the latter part of May.

Gonotropis gibbosus Lec. This species was taken in early July on living birch and maple trees, which had been injured by fire.

Stenoscelis brevis Bohm.

A dark brown or black, cylindric beetle scarcely 1/8 inch long and with prothorax and wing covers coarsely punctured, is a common borer in dead and partly rotten wood of various trees.

We have taken this species boring in dead limbs of butternut, ash, willow, poplar, and it has been recorded by others as occurring in elm and maple. It runs irregular sinuous galleries about 1/12 inch in diameter.

FUNGOUS BEETLES

There are a number of species of very diverse appearance, which feed on fungi and are frequently met with on various trees. They, of themselves, are of comparatively slight importance, and on that account they should not be confused with the more dangerous borers which may occur under similar conditions.

Tritoma thoracica Say

A rather broad, oval, black and bright red beetle about 3/16 inch in length, occurs in June and July on soft mushroom growths on decaying poplar.

The head and prothorax are bright reddish, the eyes small, finely granulate, and the wing covers are faintly striate with small, well separated punctures.

Mycetophagus punctatus Say

This somewhat elongate beetle, brightly marked with reddish brown and black, nearly ¼ inch long, infests soft fungi of basswood in June and July.

The mouth parts and extremities of the antennae are rufous, the middle portion of the latter being black. The eyes are slightly emarginate, rounded, coarsely granulate; labrum, dorsum of head and prothorax black, coarsely punctured. The wing covers have a large, black scutellar spot and are margined laterally with the same color, from which there extends near the middle a conspicuous lobe; near the posterior extremity there is a broad, somewhat irregular black band across the wing covers. These organs are rather finely striate with coarse punctures and clothed with a short, rather coarse pubescence.

Mycetophagus flexuosus Say

This rather narrow, elongated, oval beetle conspicuously marked with black and reddish, infests soft fungi on basswood in June.

The mouth parts and the extremities of the antennae are reddish, the middle segments of the latter being black. Eyes prominent, coarsely granulate; head and prothorax coarsely punctured. Wing covers with conspicuous striae composed of almost confluent punctures; reddish brown, with a conspicuous black scutellar spot extending some distance each side of the scutellum. There is a broken, irregular black band about midway of the length of the wing covers, and a nearly complete one at the posterior third; wing covers clothed with a coarse pubescence.

Triphyllus humeralis Kirby

This minute, oval, dark reddish brown beetle may be found on fungi growing on basswood.

It is about ⅛ inch in length. The head and thorax are slightly darker than the dark reddish brown wing covers, and the dorsal surface of the entire insect is faintly punctured and sparsely clothed with a short, appressed, golden pubescence.

Phenolia grossa Fabr.

This rather flattened, rounded beetle about 5/16 of an inch in length, may be taken abundantly on soft fungi on the side of fallen beech.

It is obscurely marked with black and very dark red. The head is partially covered by the enormous prothorax, which is arcuate in front, rounded laterally and coarsely and irregularly punctured. The wing covers bear several rather conspicuous though slight ridges.



Fig. 124 Calitys scabra, enlarged (original)

Calitys scabra Thunb.

This flattened, reddish beetle, about 3/8 inch in length, may be found in June on certain fungi growing on the ends of decaying hemlock logs.

This insect has a peculiar form, with enormously produced thoracic margins, which are rounded and serrate exteriorly, and the wing covers have the humeral angle produced behind in a conspicuous ridge and with the margin extended laterally and finely serrate.

Phellopsis obcordata Kirby

This peculiar appearing rusty red, dark brown beetle about 1/2 inch in length, may be found in June on certain fungi growing on the ends of decaying hemlocks.

This species is rather flattened and is remarkable on account of the enormous prothorax with its conspicuous lateral anterior protuberances. Wing covers very coarsely punctured and with the humeral angle prolonged into a conspicuous ridge, which is distinctly notched at the anterior fourth and at the posterior fourth enlarged to produce a conspicuous tubercle. There is also a thickened lateral ridge extending back to a smaller tubercle below the one mentioned above. The tips of the wing covers are also somewhat enlarged.

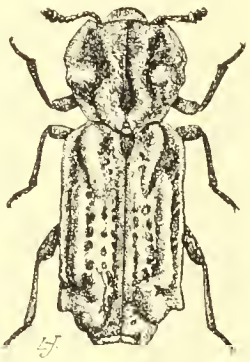


Fig. 125 Phellopsis obcordata, enlarged (original)

Upis ceramboides Linn.

This conspicuous jet black beetle, easily recognized because of the coarsely reticulate, ridged wing covers may be found in July on fungi growing on white birch.

This handsome beetle is about ¾ inch in length, jet black. Eyes inconspicuous, finely granulate; head and thorax finely punctured, and wing covers coarsely reticulate as stated above.

Platydema ruficorne Sturm.

This small, oval, dull black beetle about 3/16 inch in length feeds in fungi.

The antennae, palpi and anterior margin of the labrum are more or less rufous. The eyes are deeply emarginate, coarsely granulate, and the top of the head coarsely, and the prothorax finely punctured. The wing covers are faintly striated with a series of slight, well spaced punctures. This species occurs in early spring.

Platydema americanum Lap.

This brownish black, glistening, oval beetle about ¼ inch in length infests fungi.

The mouth parts are rufous, the eyes deeply emarginate, coarsely granulate; the labrum and dorsum of the head coarsely, and the prothorax finely punctured. The striae of the wing covers are deeper than in P. ruficorne Sturm. and the punctures a little closer. It is easily separated from the preceding by its glistening color and different form.

Platydema subcostatum Lap.

This oval, rounded, brownish black beetle about ¼ inch in length, occurs on fungi.

The mouth parts and antennae are rufous, the eyes are deeply emarginate, coarsely granulate; the labrum and dorsum of the head coarsely, and the pronotum finely punctured; wing covers somewhat deeply striated with rather coarse, slightly elongate punctures.

Diaperis hydni Fabr.

A rather stout, rounded, reddish and black beetle nearly ¼ inch long, occurs during June and July on fungus growths affecting white birch and basswood.

This species has the head and thorax jet black and the faintly striate wing covers are bright red with black markings. The latter have a black

sutural line, slightly broader posteriorly, with two circular black spots at the anterior third, one subdorsal, the other lateral, and at the posterior third a much larger irregular black spot, which is prolonged along the ventral margin.

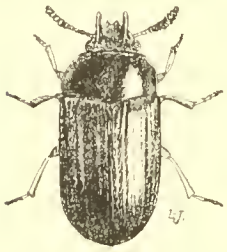


Fig. 126 Hoplocephala bicornis, enlarged (original)

Hoplocephala bicornis Oliv.

This small, rather stout, greenish beetle occurs on maple and beech fungi in April and May in association with Cratoparis lunatus Fabr.

This beetle is about 1/8 inch in length and the smaller males may be at once recognized by the two conspicuous hornlike processes on the front. The anterior margin of the labrum is also prolonged as a pair of much smaller processes.

Forked fungous beetle

Boletotherus bifurcus Fabr.

This very striking beetle occurs on fungus growing on beech and maple in June. In spite of its dull colors, its grotesque form renders it somewhat conspicuous.

Both sexes are dark brown or brownish black and are remarkable because of the peculiar irregular elevations on both head, thorax and wing

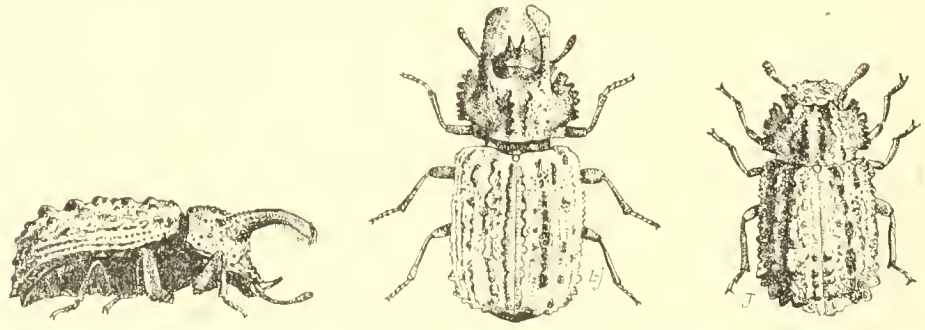


Fig. 127 Forked fungous beetle, Boletotherus bifurcus, side and dorsal view of male, dorsal view of female, enlarged (original)

covers which, in the male, are accentuated. The female has a pair of rather conspicuous tubercles on the prothorax. Her consort may be at once recognized by these prominences being prolonged into enormous horns bearing at their extremities on the underside, delicate brushes of reddish yellow hairs.

Cratoparis lunatus Fabr.

A rather stout, narrow, grayish brown mottled beetle about ¼ inch in length, may be found on fungi growing on maple and beech stumps, often associated with Hoplocephala bicornis Oliv., in April and May. It also occurs in September.

The head of this peculiar beetle is distinctly prolonged and the front thickly clothed with yellowish, grayish scales. Mandibles very large, eyes rather large and finely granulate; prothorax tapering anteriorly, slightly swollen near the middle and thickly clothed with yellowish gray pubescence, sparse posteriorly and exposing the dark brown chitin. The wing covers are strongly striate with coarse, distinct punctures and thickly clothed with yellow, brownish and almost black pubescence, giving the insect a peculiar mottled appearance.

NATURAL ENEMIES OF BARK BORERS

There are a number of natural enemies of bark borers, some of which occur on the bark or in the galleries, and one not conversant with their habits might easily mistake them for destructive species. A few of the more important of these beneficial forms are noticed briefly on the following pages.

Ibalia maculipennis Hald.

This striking and peculiar cynipid was taken at Poughkeepsie, N. Y. ovipositing on hickory infested with Dicerca obscura var. lurida Fabr., and a species of tremex. The European I. cultellator Latr., has been recorded as a rare parasite on tremex and it is possible that this species has similar habits.



It is a small, wasplike insect about 5/8 inch long, with the membranous wings clouded near the middle and at the tip. It is black, marked with yellowish and at once recognizable because of the very strongly compressed abdomen with its alternate irregular bands of black and yellowish white.

Xylonomus albopictus Cress.

Specimens of this parasite were cut from hickory infested by Dicerca obscura var. lurida Fabr., on which it was probably parasitic. It has been recorded by Dr Hopkins as a parasite of buprestid larvae.

Foenus tarsatorius Say

This insect was observed ovipositing on butternut. It is undoubtedly a parasite of some wood borers infesting this tree.

American bark beetle destroyer

Thanasimus dubius Fabr.

This is one of the commoner, larger clerids. It measures nearly 3/8 inch in length, and may be recognized by the head, thorax and basal portions of the wing covers being a dull red. The remainder of the wing covers is jet-black, except for the irregular transverse, silvery markings. This predaceous bark beetle was observed in 1901 in small numbers on white pine which had been nearly killed by bark borers at Bath-on-Hudson, and several beetles and a number of larvae were seen, though only one adult was captured.

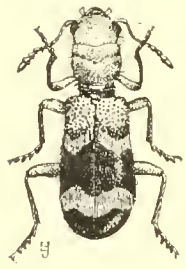


Fig. 129 Thanasimus dubius, enlarged (original)

This species has been met with repeatedly by Dr Hopkins in his investigations of insects affecting forest trees in West Virginia, and he states that this form is the one most closely related to the European species, Clerus formicarius Linn., which was introduced by him in 1892, in the hope that it would prove a very efficient agent in preventing serious outbreaks of bark borers.

The American bark beetle destroyer passes the winter in all stages from larva to adult, as stated by Dr Hopkins, in the bark under which it breeds and sometimes in the loose bark and moss at the base of the tree. The beetles appear in the spring, and soon after bark beetles begin to emerge from their winter quarters, fly to infested trees, logs or tops, where they station themselves beneath loose flakes of bark, awaiting an opportunity to pounce on their prey. They also move rapidly over the bark in

search of beetles or for entrances to galleries of the bark borers, in which the females deposit eggs. These soon hatch, and the minute active grubs find their way into the egg and brood galleries of the bark borers where they may frequently be found by the collector. These beneficial grubs feed on the eggs and young of the bark borers till they have attained full growth, when they leave the inner bark and excavate cavities in the outer bark where the transformation to the adult occurs.

This clerid attacks and feeds on all kinds of bark beetles which infest the spruce and pine, and it has also been found attacking bark beetles in deciduous trees. It is a common insect wherever pine and spruce grow in West Virginia according to Dr Hopkins. This beneficial species is unfortunately preyed on by at least two parasites. One braconid apparently attacks the full grown larva when it enters the outer bark to pupate and lives within its host. This parasite is in turn attacked by another which Dr Hopkins bred in large numbers from clerid larvae. A small, two winged fly, resembling a house fly, deposits its eggs on the living beetle, and the maggot hatching therefrom, enters the abdomen and subsists by absorbing nourishment from the body fluids of its host. The infested beetles remain alive and active, till the parasitic larva leaves it to undergo its final transformations, which probably take place in the ground. This clerid has been recorded by Dr Smith as generally, though locally, distributed through New Jersey. Dr J. A. Lintner[1] observed numbers of these insects on cut pine and timber at Schoharie, May 13, where they had probably been feeding on wood-boring grubs.

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1899 **Hopkins, A. D.** W. Va. Agric. Exp. Sta. Bul. 56, p. 262–64

Elasmocerus terminatus Say

A small, cylindric, nearly black beetle about ¼ inch long, may be found with Lyctus and some other borers in infested wood.

This very interesting clerid was obtained from a piece of ash badly infested with Lyctus parallelopipedus Melsh., on which it evidently preys.

[1] 1888 Lintner, J. A. Ins. N. Y. 4th Rep't, p. 142.

Description. The adult beetle is about 1/4 inch long, with the head, antennae, legs and wing covers jet-black. The reddish yellow thorax is marked by a median, large black spot. This beetle is remarkable on account of the very large terminal antennal segment, which equals in length the remainder of that organ. The head and wing covers are coarsely punctured, eyes coarsely granulate. The abdomen is reddish, with the terminal segment black. This species has been bred abundantly by Dr Hamilton from grapevines infested by Phymatodes amoenus Say, on which it preys, and Dr Hopkins records finding it with Sinoxylon basilare Say, Agrilus otiosus Say, and Chramesus hicoriae Lec. in dead hickory branches, while Dr Smith states that he has found it on trees infested with Scolytus and Bostrichus, adding that it is not uncommon.



Fig. 130 Elasmocerus terminatus, enlarged (original)

Distribution. This species probably has a wide distribution in the United States, since it occurs in New York, and has been recorded from Ohio, New Jersey, District of Columbia and West Virginia.

Orange-banded clerid

Clerus ichneumoneus Fabr.

This very striking black and red marked insect preys on developing broods of the hickory bark beetle, Scolytus quadrispinosus Say, and wherever abundant is undoubtedly of considerable service in checking that destructive bark beetle.

This beneficial species is about 5/16 inch in length, bright red, with a small interrupted black band just behind the shoulders, and a broader continuous one at the posterior third of the wing covers, which latter are gray apically. This species has been recorded by Messrs Ulke and Dury from Washington D. C. and the vicinity of Cincinnati O. respectively, and we have received specimens from Kansas through the kindness of Dr Snow.

Scarlet winged clerid

Thanerocleras sanguineus Say

This brilliant little beetle occurs under the dead bark of maple and beech in dry situations. It is only about 3/16 inch in length and has a dark brown, rather coarsely punctured pubescent head and thorax and may be easily recognized by the brilliant scarlet wing covers which are coarsely though irregularly punctured.

Phyllobaenus dislocatus Say

A small, blackish, yellow-marked beetle about 3/16 inch in length, may be met with in the galleries of certain bark borers.

This species was reared from hickory limbs obtained at Ilion N. Y., the adults appearing June 20. The tree was also infested with Chrysobothris femorata Fabr., and Magdalis olyra Herbst, which were preyed on by several parasites, and this clerid may possibly have been subsisting on the latter borer.

Description. The adult beetle is about 3/16 inch in length, the head and thorax black, and the wing covers jet-black, marked with pale yellowish, having an irregular oblique mark near the humeri and one near the posterior third, with a small spot near the tip. The head and thorax are rather coarsely punctured, and the wing covers are ornamented with very coarse, almost confluent punctures. This species, according to Dr Hopkins, attacks Polygraphus rufipennis Kirby in black spruce, and Pityophthorus consimilis Lec. in sumac, and he found it associated with Scolytus rugulosus Ratz. in apple. Adults were obtained by him from the middle to the latter part of June and in early December.



Fig. 131 Phyllobaenus dislocatus, enlarged (original)

Distribution. This species probably has a wide distribution in the eastern United States, since it occurs in New York, and has been listed from the vicinity of Cincinnati O., southwestern Pennsylvania, various localities in New Jersey, and from West Virginia.

Chariessa pilosa Forst.

This rather stout, black beetle with yellow-margined prothorax, may be easily recognized by reference to the accompanying figure.



Fig. 132 Chariessa pilosa, enlarged (original)

This clerid, about ½ inch long, is predaceous and undoubtedly renders considerable service in keeping various pests in check. Specimens were taken at Poughkeepsie on a hickory tree in which Dicerca lurida Fabr. was ovipositing, and Dr Smith records its occurrence in New Jersey on oaks and also pear infested by the sinuate borer, Agrilus sinuatus Oliv., the larva probably preying on the pupa of this latter insect. Dr Hopkins states that the larvae are very efficient checks on several of our destructive flat-headed buprestid borers.

Hypophloeus cavus Lec.

This very dark brown beetle about ⅛ inch long, occurs in the galleries of Scolytus quadrispinosus Say, and has been recorded in those of Xyleborus celsus Eich., preying undoubtedly on this ambrosia beetle. It has been recorded from the vicinity of Washington, West Virginia and New Jersey, and is probably widely distributed in the northeastern United States. The antennae are reddish, stout, moniliform, the terminal segments being larger than the basal ones. The eyes are prominent, black, coarsely granulate; the head and prothorax brown, irregularly and finely punctured, the latter being remarkable because of the prominent median sulcation. The wing covers are very dark brown or black, sparsely clothed with rather coarse hairs and irregularly and finely punctured.

Bothrideres geminatus Say

This rather slender, slightly flattened, light brown beetle about 1/8 inch long, was taken in the galleries of Scolytus quadrispinosus Say, and it has also been found by Dr Smith under dry oak bark.

This species has brownish, moniliform antennae, the two apical segments being distinctly enlarged. The prominent eyes are coarsely granulate and the head and prothorax coarsely and confluently punctured, the latter with expanded margins, particularly anteriorly. The wing covers are strongly ridged and the entire body sparsely clothed with rather long, golden yellow setae.

LEAF EATERS AFFECTING DECIDUOUS FOREST TREES

This comprises a very large assembly of species, many of which are of very little importance. It is impossible to adequately notice all the species found on forest trees, consequently this portion of the work is by no means complete.

Leaf eaters

Small, triangular, flattened, metallic beetles occur in midsummer on oak and elm leaves,
Brachys aerosa, p. 512
B. ovata, p. 513

A small, stout, brown and black beetle a trifle less than ¼ inch long, occurs on scrub oak in June.. ..... Serica trociformis, p. 514

Yellowish brown, black-margined flea beetles about 3/16 inch long, feed in summer on oak, hickory and birch.... Black-margined flea beetle, Systena marginalis, p. 515

A small, shining, dark brown, black-headed leaf beetle ¼ inch long on scrub oak in July
Tymnes tricolor, p. 515

A slaty gray, brown-striped weevil ¼ inch long on oak in July
Aphrastus taeniatus, p. 515

Terminal lobes of oak leaves rolled into neat cylindric cases containing an egg, may be the work of this species....Two spotted curculio, Attelabus bipustulatus, p. 516

A large, greenish weevil ½ inch long, occurs on the buds of a variety of trees from May to July..... New York weevil, Ithycerus noveboracensis, p. 517

A stout, light apple-green caterpillar with a conspicuous caudal horn and seven lateral oblique white stripes, feeds on hickory, black walnut and ironwood
Walnut sphinx, Cressonia juglandis, p. 518

A red-headed, striped caterpillar with a conspicuous red hump on the eighth abdominal segment, feeds on oak in midsummer
Red-humped oak caterpillar, Symmerista albifrons, p. 519

A red-headed, grayish caterpillar about 1½ inches long, with conspicuous pointed elevations on the first and eighth abdominal segments, occurs on oak in midsummer
Rosy Hyparpax, Hyparpax aurora, p. 520

A pale greenish caterpillar about ½ inch long, with a more or less distinct yellowish lateral line, occurs on oaks and various other trees in midsummer
Green oak caterpillar, Nadata gibbosa, p. 521

A large, greenish, stout caterpillar with fascicles of irritating, sharp spines over the body, feeds in late summer on the foliage of oak and other trees
Io caterpillar, Automeris io, p. 521

A yellow-headed, light yellowish, tufted caterpillar closely resembling that of the white marked tussock moth, feeds on oak and a number of other trees

Definite-marked tussock moth, Hemerocampa definita, p. 522

A black-headed caterpillar about 1¼ inches long, thickly clothed with yellowish hairs and black tufts of the same, feeds in September on a variety of trees

Oak tussock caterpillar, Halisidota maculata, p. 523

A yellowish, brown-headed caterpillar about 1¼ inches long, clothed with delicate buff yellow hairs and with four light brown dorsal pencils of the same, feeds in the fall on a large variety of trees... Pale tussock caterpillar, Halisidota tessellaris, p. 523

A black-headed, yellow or white-tufted caterpillar with a black hair pencil on each side, feeds on most deciduous forest trees

Rusty tussock moth, Notolophus antiqua, p. 524

A black-headed caterpillar clothed with grayish hairs and with two black hair pencils on the second segment, and square tufts on segments 5 to 12, feeds on various deciduous forest trees..... Dark tussock moth, Olene achatina, p. 524

Large caterpillars thickly covered with greenish yellow and bearing a pair of long, black hair pencils on the first and third abdominal segments and a single one on the eighth, occurs in September on a variety of trees

American dagger moth, Apatela americana, p. 525

A grayish, scarlet-marked caterpillar about 2½ inches long, remarkable because of the large bordering fringes on each side, occurs in September on oak, ash and apple

American lappet moth, Epicnaptera americana, p. 525

A very large, pea-green, brown-headed, fleshy caterpillar with small reddish brown tubercles with silvered bases, occurs in midsummer on the foliage of a great variety of plants..... American silk worm, Telea polyphemus, p. 526

A stout, apple-green caterpillar about 3 inches long and with six rows of small, pink, hair-bearing tubercles, occurs in midsummer on a variety of trees

Luna moth, Tropaea luna, p. 526

A bright, tawny or orange-colored caterpillar with a dusky stripe along its back and prominent spines on its thoracic segments, feeds on oak in September

Spiny oak worm, Anisota stigma, p. 527

Peculiar, brightly colored, variously shaped and usually motionless, sluglike caterpillars occur in midsummer on the foliage of various deciduous trees

Slug caterpillars, p. 527

A peculiar larva about 1 inch long, thickly covered with long, mouse gray and fawn-colored hairs, occurs on the foliage of various trees in September and October

Crinkled flannel moth, Lagoa crispata, p. 529

A slaty brown measuring worm with two pairs of peculiar dorsal filaments, occurs in June on oak, maple and currant..... Filament bearer, Anaia limbata, p. 530

Black-headed, yellowish green caterpillars forming thick web nests on scrub oaks in early June..... Archips fervidana, p. 530

Delicate green, brown-headed caterpillars about ¾ inch long feed on oak and other trees in early June, August and September

V-marked leaf roller, Archips argyrospila, p. 531

A small, light green, brown-headed caterpillar feeds in early June on the foliage of a considerable number of trees..... Red-banded leaf roller, Eulia triferana, p. 532

A grass-green larva about ¾ inch long occurs during July in folded oak leaves

Oak leaf roller, Tortrix quercifoliana, p. 532

Whitish, blotchlike mines on the upper surface of oak leaves, contain minute footless, brownish and yellow larvae

White-blotch oak leaf miner, Lithocolletes hamadryella, p. 532

Similar mines on the under surface and possibly on the upper

Fitch's oak leaf miner, Lithocolletes fitchella, p. 533

Green or brown, sticklike insects sometimes measuring 3 inches in length, occur in forests of deciduous trees in early autumn

Walking stick, Diapheromera femorata, p. 533

Clusters of black, yellow-striped caterpillars about 2 inches long, occur on hickory, walnut and birch..... Striped hickory caterpillar, Datana angusii, p. 535

Clusters of black, yellow-necked, yellow-striped caterpillars nearly 2 inches long, occur in midsummer on the twigs of a variety of trees

Yellow-necked apple worm, Datana ministra, p. 535

Large, flocculent masses on the underside of butternut leaves in midsummer, may conceal a bluish, yellowish white sawfly larva about ¾ inch long

Butternut woolly worm, Monophadnus caryae, p. 536

Small, roundish, brown and black marked or black beetles about 1/16 inch long, occur on butternut and mountain ash in May..... Typophorus canellus, p. 537

A large, pale yellowish green larva striped with darker green, occurs in midsummer on maple trees..... Green-striped maple worm, Anisota rubicunda, p. 537

A drab-colored caterpillar with a large, orange, dorsal spot exposed at the juncture of the first and second abdominal segments when the body bends, feeds on maple, oak, willow and rose..... Semilooper maple worm, Homoptera lunata, p. 538

A very large, pale green caterpillar about 4 inches long, ornamented with conspicuous green, blue, yellow and red tubercles, feeds on the foliage of a large number of trees and shrubs..... Cecropia moth, Samia cecropia, p. 539

A large, slender bodied spanworm about 1¾ inches long and marked with dark purple brown and reddish markings, occurs on maples in July

Large maple spanworm, Sabulodes transversata, p. 539

Small caterpillars boring maple or buckeye leaf petioles cause the foliage to drop in early summer..... Maple leaf stalk borer, Epinotia claypoleana, p. 540

Maple leaves with irregular, oval holes 1/10 to 4/10 inch in diameter may have been injured by this species..... Maple leaf cutter, Incurvaria acerifoliella, p. 541

Yellowish, black-spotted, caterpillarlike larvae nearly ¾ inch long, feed on the foliage of American elms in August..... Hylotoma scapularis, p. 542

A brilliant, bottle-green, oval beetle 1/8 inch long, with silvery white, green-marked wing-covers, feeds on the leaves of elm, linden, willow and alder

Alder leaf beetle, Chrysomela scalaris, p. 542

A small, long-snouted weevil about 3/16 inch long, with strongly ridged elytra and prettily marked with dark brown, yellowish white and reddish brown, occurs on elm

Conotrachelus anaglypticus, p. 544

A red-headed, black-spined caterpillar about 1 inch long, feeds on elm foliage

Violet tip, Polygonia interrogationis, p. 544

A yellowish, spiny, black-marked caterpillar about 1 inch long, feeds on elm

Hop merchant, Polygonia comma, p. 545

A brown-headed, yellowish brown, spiny caterpillar about 1 inch long, feeds on elm

Gray comma, Polygonia progne, p. 546

A stout, pale green or reddish brown larva about 3 inches long, with a conspicuous caudal horn and four large, tubercular elevations on the thoracic segments, occurs in early September on elm, beech, linden and probably ash

Four-lined sphinx, Ceratomia amyntor, p. 546

Dark striped measuring worms about 1 inch long, defoliate apple and elm trees in early spring..... Spring cankerworm, Paleacrita vernata, p. 547

A stout, apple-green caterpillar 3 inches long, with seven oblique stripes on each side and a light blue caudal horn, feeds on the leaves of ash, lilac and mountain laurel

Ash sphinx, Sphinx kalmiae, p. 548

A variable, light green caterpillar about 1¾ inches long, with reddish legs and caudal horn and a series of seven oblique white stripes on each side of the body, feeds on the foliage of white and black ash, lilac and privet

Wavy ash sphinx, Ceratomia undulosa, p. 548

A pretty, yellowish or whitish, long-haired caterpillar about 1½ inches long, with three dark hair pencils arising on the median line, occurs in midsummer on various food-plants ..... Apatelodes torrefacta, p. 549

Black-headed, yellowish green, black-spotted, false caterpillars nearly ¾ inch long, feed in August on chokecherry foliage..... Hylotoma macleayi, p. 549

A small, red leaf beetle about 1/5 inch long, eats in midsummer irregular, round holes in the leaves of wild cherrytrees

Cherry leaf beetle, Galerucella cavicollis, p. 550

Web tents in the forks of wild cherry and apple trees in early spring

Apple tent caterpillar, Malacosoma americana, p. 550

Brown, webbed-together leaves occur on wild cherry shoots in July and August

Cherry scallop shell moth, Hydria undulata, p. 551

Yellow, black-headed caterpillars about ½ inch long, web together chokecherry leaves in midsummer..... Ugly nest cherry worm, Archips cerasivorana, p. 552

A greenish solitary sawfly larva resting on its venter on the underside of shadbush leaves

Pteronus thoracicus, p. 553

A large, brownish caterpillar with conspicuous angular, cream-colored markings on its middle and at its posterior extremity, is sometimes abundant on prickly ash

Orange dog, Papilio thoas, p. 554

A small leaf miner works in sour gum leaves the latter part of August and early September, cutting oval cases therefrom the latter part of that month

Sour gum case cutter, Antispila nyssaefoliella, p. 555

A red-headed, blue flea beetle about 1/8 inch long, is sometimes abundant on locust and apple foliage..... Red-footed flea beetle, Crepidodera rufipes, p. 556

Large, pale green caterpillars about 2 inches long, with a red neck and large, red head and yellow spot on each side of the mouth, draw the leaves of locust together and feed by night..... Locust leaf folder, Epargyreus tityrus, p. 556

A large, delicate, bluish white caterpillar with four large, yellow or red tubercles on the posterior thoracic segment and a large one on the dorsum of the eighth abdominal segment, feeds on the foliage of lilac and a number of trees and plants

Promethea moth, Callosamia promethea, p. 557

A whitish, green-tinted sawfly larva on willow, white and yellow birch, belongs to this species..... Pristiphora sycophanta, p. 557

A pale brown, black-spotted beetle about ¼ inch long, is occasionally destructive to willow and poplar..... Poplar leaf beetle, Phytodecta pallida, p. 558

A somewhat tuberculate, angular, reddish brown, yellowish marked caterpillar about 1 inch long, feeds singly on willow and poplar

Viceroy, Basilarchia archippus, p. 559

A peculiar, light green, brown-marked caterpillar with a pair of long, slender, annulated caudal appendages, occurs on willows and poplars..... Harpyia cinerea, p. 559

A black-headed, velvety black caterpillar, usually with a conspicuous somewhat broken subdorsal yellow stripe and another along the stigmatal line, occurs in the fall on poplar, willow and other trees and shrubs
Smeared dagger moth, Apatela oblinita, p. 560

A black, yellow-striped larva about 1¼ inches long, feeds in the folded, webbed-together leaves of poplars and willows... Poplar tent maker, Melalopha inclusa, p. 560

A yellowish sawfly larva occurs on willow..... Pteronus mendicus, p. 561

A black-headed, light green sawfly larva on willow..... Pteronus odoratus, p. 562

A striped, rather stout, black and yellow beetle about ¼ inch long, occurs in June on willow
Willow flea beetle, Disonycha caroliniana, p. 563

A reddish, black-spotted beetle about ¼ inch long, feeds during the summer on willow leaves..... Spotted willow leaf beetle, Melasoma lapponica, p. 564

A yellowish, black-marked, hemispheric beetle ¼ inch long, feeds the latter part of the summer on willows and hard pine..... Chrysomela bigsbyana, p. 566

A dull red leaf beetle about ¼ inch long, feeds on willow
Dull red willow leaf beetle, Galerucella decora, p. 566

A small, brownish, long-snouted beetle thickly clothed with golden and brownish pubescence, occurs in considerable numbers on willow in early spring
Elleschus ephippiatus, p. 567

Orange-yellow, black-spotted larvae about ⅞ inch long, feed side by side on the foliage of poplars in early June.... Poplar sawfly, Trichiocampus viminalis, p. 568

Black-headed, bluish or leaf-green sawflies feed on the edge of poplar leaves
Pteronus hudsonii, p. 569

A greenish, solitary edge-feeding sawfly on poplar.. Pteronus vertebratus, p. 570

Yellowish, black-spotted sawfly larvae feed during August and September on birches
Hylotoma pectoralis, p. 570

A brown-headed, greenish solitary sawfly larva feeds on the underside of birch leaves
Nematus unicolor, p. 571

Brown-headed, purplish solitary or partly gregarious sawfly larvae occur on white birch
Pteronus latifasciatus, p. 572

A black-headed, greenish sawfly larva feeding gregariously on the edges of alder leaves
Amauronematus luteotergum, p. 572

Deep prussian blue, rounded flea beetles about ⅛ inch long, or dark brown, black-headed, black-tubercled larvae occur in large numbers on alder
Alder flea beetle, Haltica bimarginata, p. 573

Peculiar, thimblelike rolls of leaves on alder, hazel and sumac may be the work of this species ..... Attelabus rhois, p. 574

Reddish, black-ringed caterpillars about 1½ inches long, feed from June to August on Virginia creeper and grape.. Eight-spotted forester, Alypia octomaculata, p. 575

Sprawly, yellowish green beetles about ⅜ inch long, swarm on rosebushes and the foliage of trees and shrubs ..... Rose beetle, Macrodactylus subspinosus, p. 575

Greenish, black-headed caterpillars about ½ inch long, bore in the buds or web together leaves of roses..... Rose bud worm, Olethreutes nimbatana, p. 576

Yellow-headed, dark green larvae tying rose leaves together
Rose leaf tier, Olethreutes cyanana, p. 577

Yellowish green, brown-headed caterpillars ½ inch long occur on oak and rose
Cenopis pettitana, p. 579
Cenopis reticulatana, p. 580

Brown headed, greenish caterpillars about ¾ inch long, live in the webbed leaves of roses and those of a large number of trees
Oblique banded leaf roller, Archips rosaceana, p. 580
Rose leaf folder, Archips rosana, p. 581

Insects affecting fruit of deciduous forest trees

A curculio much resembling the plum pest, though larger, ¼ inch long, frequently infests walnuts and butternuts... Walnut curculio, Conotrachelus juglandis, p. 581
Conotrachelus seniculus, p. 582

A slender, white caterpillar about ⅜ inch long, mines hickory shucks, causing them to abort and fall prematurely..... Hickory shuck worm, Enarmonia caryana, p. 583

A weevil with a remarkably long, slender, curved beak, occurs on acorns or may be bred from white, legless grubs within them or other nuts
Acorn weevil, Balaninus nasicus, p. 583

A similar weevil and legless grubs occur in chestnuts
Chestnut weevils Balaninus proboscideus and B. rectus, p. 585

Frequenters, usually injurious, of deciduous forest trees ..... p. 588

Frequenters, usually beneficial, of deciduous forest trees..... p. 603

Plant galls and gall makers ..... p. 615

Brachys aerosa Melsh.

A triangular, flattened, metallic colored beetle about 3/16 inch in length, occurs on oak and elm leaves in midsummer.

A number of examples of this species were taken on elm May 20, 1903, at Poughkeepsie N. Y., where they were eating irregular, oval holes near the edges of the leaves.

Description. This beetle is about 3/16 inch in length, subtriangular in outline, metallic in color, the head and thorax being golden, the basal portion of the wing covers greenish and purple and their tips reddish and yellow.

The larva has been described by Professor Gillette as "whitish, 9 mm long, flattened, segments deeply notched; head widest and body gradually tapering to the tail. The mandibles are brown and the prothoracic segment has brown, rectangular plates above and below. The anal extremity is provided with a small spine extending behind, which is used by the larva in progression."

Life history and habits. The adults, as stated above, feed on elm leaves, and according to Professor Gillette, probably on oak also. He states that in October 1886, while collecting leaf miners, he obtained larvae of two of these beetles from poplar, from which adults were bred later. Dr Packard states that he has found this small buprestid on the leaves of oak early in summer in Maine, and late in May near Providence, and adds that the larva probably mines the foliage.

Distribution. This species is probably generally distributed in the northeastern United States at least, since it has been recorded from the vicinity of Buffalo N. Y., from southwestern Pennsylvania and the District of Columbia, and is not rare on oak throughout New Jersey.

Brachys ovata Weber

A small, triangular, metallic colored beetle about 3/16 inch in length, may be found abundantly on scrub oak foliage in May and June.

This species was very numerous on scrub oaks at Karner during the latter part of May and June 1901. The beetles rested quietly on the leaves or ate irregular holes through the tissues and when startled, flew readily.

Description. This small, flattened buprestid is subtriangular in outline, metallic green or olive in color and ornamented with sparse gray and fulvous pubescence. The elytra have a stout, sublateral ridge, and there may be one or two more or less rudimentary ones between it and the suture.

Life history and habits. The beetles are abroad, as previously stated, during May and June, and according to Professors Gillette and Hubbard, the grub is a miner of oak leaves. Mr Hubbard states that the beetle occasionally eats small holes in orange leaves, and leaves us to infer that the larvae are found only in oak foliage.



Fig. 133 Brachys ovata enlarged (original)

Distribution. This species has been recorded by Dr LeConte from the Middle, Southern and Western States, and local lists show that it is presumably generally present in various sections, since Dr Smith states that it is common throughout the State on oak, and adds that the variety, tessellata Fabr. occurs on pine. It has been recorded from the vicinity of Buffalo N. Y. and Cincinnati O., and listed by Ulke from the District of Columbia, and Dr Hamilton states that it is common on oak in southwestern Pennsylvania.

Serica trociformis Burm.

This is a small, stout brown and black beetle a trifle less than ¼ inch long. It may be recognized by its black head, very dark thorax, and brick-red, rather deeply striated wing covers, and by its stout, somewhat rotund shape, so characteristic of the allied June beetles.

This species was somewhat common on the scrub oaks at Karner in June 1901, and much more so the following May and June, when it was exceedingly abundant and large numbers could be captured with very little effort. A few were also taken on poplar, evidently an accidental occurrence. The insects eat small, irregular holes in the foliage, and fly readily from one leaf to another. One of the beetles was observed in the grasp of a large robber fly, though the specific identity of the latter could not be determined.

This species occurs in a number of localities in New Jersey, according to Dr Smith. Prof. W. E. Britton found it abundant on young hornbeam trees, Carpinus caroliniana, at Westville Ct., May 30, 1898. They were so numerous that the foliage was completely riddled in some cases.

Black-margined flea beetle

Systena marginalis Ill.

A yellowish brown, black-margined flea beetle about 1/6 inch long, feeds in summer and autumn on oak, hickory and birch.

This little species appears to be a somewhat general feeder and occasionally it occurs in great numbers. It may be recognized by its yellowish brown color in connection with the narrow, black margin on the prothorax and wing covers. The eyes are rather prominent, finely granulate; the head smooth, and the prothorax closely and shallowly punctured. The wing covers are ornamented with irregular, small, rather deep punctures. This species occurs about Albany and has been taken in Ontario by Mr Harrington, who found it abundant on oak, elm and other trees in midsummer and also on sweet hickory. It has been recorded by Dr Smith from New Jersey, who states that it is sometimes numerous on oaks. It has also been listed from the vicinity of Washington.

Tymnes tricolor Fabr.

This small, shining leaf beetle about 1/4 inch in length, has a dark brown or nearly black head and prothorax and reddish brown wing covers, which are slightly and irregularly punctured.

A single example of this species was taken July 8, 1901 on scrub oak at Karner. It has been recorded by Dr Smith as local throughout New Jersey, where it occurs on chestnut, hickory and other plants.

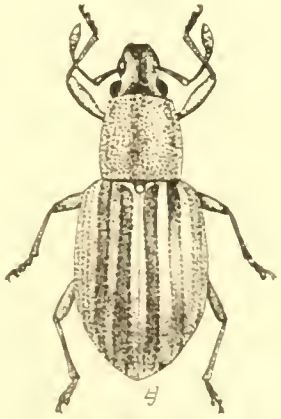


Fig. 134 Aphrastus taeniatus, enlarged (original)

Aphrastus taeniatus Gyll.

This slaty gray-brown, striped weevil, about 1/4 inch in length, was taken in small numbers on scrub oak at Karner, one specimen being captured July 27, 1901. Its distribution has been given by Dr Horn as the Middle and Southern States and Dr J. B. Smith records it as occurring throughout New Jersey on pawpaw, hazel and other bushes in July.

Two spotted curculio

Attelabus bipustulatus Fabr.

Portions of the terminal lobes of oak leaves rolled into neat, cylindric cases containing an egg, may be the work of this species.

The peculiar rolled, usually cylindric cases of this species are occasionally met with in early spring on oaks of various species, it having been recorded on the red, post and laurel oak. The work of this beetle has been observed, though it is not abundant in the vicinity of Albany. The insect has been listed from New Jersey, District of Columbia and also from the vicinity of Cincinnati O. Dr Packard has recorded this species from near Providence R. I.

Description. *Larva.* Average dorsal length, .22 inch; diameter on abdominal segments, .06 inch, tapering anteriorly from fourth segment. Yellowish white; thoracic segments slightly depressed on the back and smaller beneath; abdominal segments convex above and flat beneath, each one divided into three irregular shallow transverse folds, lateral surfaces with a double row of smooth polished oval tubercles, most symmetric in form and position from segments 4 to 11 inclusive; above the tubercles on each segment is a deep depression. Head horizontal, rounded, small, about half the diameter of segment next behind, into which it retreats; white, the mandibles and other mouth parts reddish brown, surrounded by long hairs.

The pupa is cream white, .12 inch long; abdominal segments sharply ridged; posterior extremity terminates in a pair of bristly points, white, tipped with brown. *Murtfeldt*

The egg has been described by Riley as almost globular, slightly ovoid, tender, pale yellowish and translucent. It is deposited near the tip on the underside of the leaf, which is then cut transversely near its middle, punctured a short distance each side of the midrib, which causes it to fold with its lower side out, then curled round and the outer edges tucked in.

The beetle is about 3/16 inch long, rather stout, highly polished, black, with two large orange-red spots at the base of the wings.

Life history and habits. This beetle has the curious habit of rolling up a leaf, trimming and tucking in the lower ends with her beak. The egg is first deposited near the tip of the leaf, and a little to one side; the blade of the leaf is then cut through on both sides of the midrib, about 1½ inches

below ; a row of punctures is made on each side of the midrib of the severed portion, which facilitates folding the leaf together, upper surface inside, after which the folded leaf is tightly rolled up from the apex to the transverse cut, bringing the egg in the center ; the concluding operation is the tucking in and trimming off the irregularities of the ends. A few days after completion, the cases, first observed the latter part of April, dropped to the ground ; by May 15 several larvae hatched and fed on the dry substance of their nest, and by the end of May they pupated within the nest ; this state lasted from five to seven days, the first beetles issuing by June 2, while a second brood of larvae may be found early in July. The above is based largely on Dr Packard's account.

New York weevil

Ithycerus noveboracensis Forst.

A large, grayish weevil about ½ inch long, occurs on the buds of a variety of trees from May to July.

This giant weevil is of interest on account of its large size, it not being exceeded in dimensions by any of our native species.

Description. The head is prolonged into a short, rather stout, slightly tricarinate beak tipped with a pair of large jaws, eyes reddish. The head and prothorax are coarsely punctured and rather thickly clothed with a yellowish and white pubescence. The wing covers are deeply striate and are also rather thickly clothed with a yellowish and whitish pubescence and each bears a series of about 10 rather inconspicuous circular brown spots.

Life history and habits. This large weevil has been recorded on the twigs of oak, hickory and a variety of fruit and forest trees. Mr Harrington considers beech as a favorite food plant for both larvae and beetles. He has met with weevils in early June and two or three days later failed to find any specimens on the same tree, concluding therefrom that the beetles were abroad during a very limited time. We have taken specimens in New York July 19, and as they also occur in May and June, this would seem to indicate that adults might be abroad during an extended

period. The beetles eat the buds and gnaw into the twigs chiefly at the base, thus causing them to break and fall. They also feed on the younger bark of twigs, eating numerous holes into it, the tender shoots being entirely devoured, and later they may feed on the base of leaves. It is a nocturnal species and consequently escapes observation to a large extent. The larvae are found in the twigs and tender branches of oak and hickory, and according to Saunders, the female makes a longitudinal excavation with her jaws for the reception of the eggs. The larva is a soft, footless, pale yellow grub with a tawny head.

Agrilus otiosus Say has been taken from ash, oak and butternut foliage.

Anthaxia quercata Fabr. was taken on leaves of scrub oak at Karner July 23, 1902.

Cistela sericea Say occurs on basswood the latter part of June on oak and also on pine.

Glyptoscelis barbata Say was taken on hickory and oak at Poughkeepsie in May and June 1903.

Rhynchites bicolor Fabr. is common on scrub oak at Karner.

Walnut sphinx

Cressonia juglandis Abb. & Sm.

A stout, light apple-green caterpillar with a prominent horn at its posterior extremity, and ornamented with seven oblique white stripes on each side, feeds on the leaves of hickory, black walnut, ironwood and has been reported as occurring on wild cherry.

The parent insect is a modestly colored, yellowish brown hawk moth having a wing spread of about 2½ inches. The fore wings bear a nearly straight, oblique, light brown line at the basal third, and near the outer edge there are three slightly undulating, light brown lines. These latter markings are slightly more developed on the posterior wings. The young larva is yellowish green. The head is truncate in front, conic, the apex of the cone bearing two rough, brownish projections. There is a yellowish strip on each side of the head and the lateral streaks on the body are very indistinct. The caudal horn is rough, pinkish at the base and has black points on the surface. The full grown larva tapers from the seventh

segment toward the extremities, is light apple-green, granulated with white and with seven oblique stripes on each side, formed by the whitish granulations which are more numerous there than elsewhere. The caudal horn is 1/5 inch long, brownish, and covered with black spinules. The head is quite pointed and bifid at the top.

Red-humped oak caterpillar

Symmerista albifrons Abb. & Sm.

A red-headed, striped caterpillar with a conspicuous red hump on the eighth abdominal segment, feeds on oak in midsummer.

This is a rather common species on oak, and in its early stages at least, is easily recognized by its very large, swollen red head in conjunction with the conspicuous reddish enlargement on the eighth abdominal segment. Ordinarily these caterpillars are not very abundant, though there are records of considerable areas being defoliated by voracious hosts belonging to this species. Dr James Fletcher records serious injury to both oaks and maples at Ottawa Can. in 1884.

Description. The larva has a large, orange-red, swollen head distinctly raised toward the apex. It is wider than the thoracic segments and the body increases gradually in width back to the red enlargement of the eighth abdominal segment. The body is smooth, shining, with no hairs and ornamented with a pair of subdorsal yellow lines inclosing five median black lines on a pale lilac ground. There are three black lines below the yellow line and a second yellow line below the spiracles. Anal legs pale orange-red, true legs pale orange. Length when full grown about 1½ inches.

The moth has a wing expanse of about 2¾ inches and is easily recognized by its whitish ash color, the square apex of the fore wings and the broad white costal margin on the outer two thirds of the same.

Life history. The pale green, subglobose eggs are laid in small masses on the underside of the leaves, and the young caterpillars, at first gregarious, scatter over the tree after the first or second molt. The larvae are common on white oaks in August and through September, attaining full

growth early in October and pupating within a thin cocoon between the leaves, the moths appearing the following June.

Food plants. This species displays a marked preference for oak. It is also injurious to maple, as stated by Dr Fletcher, and Dr Packard has observed it at Brunswick Me. on beech. It is widely distributed, ranging from Georgia and Texas north into Canada and westward to at least Minnesota.

Rosy hyparpax

Hyparpax aurora Abb. & Sm.

A greenish caterpillar about 1½ inches long, with a red head and conspicuous pointed elevations on the first and eighth abdominal segments and variable brown and yellowish or pinkish dorsal markings, occurs on different species of oak during midsummer.

This, one of our most striking caterpillars, is rarely abundant. It may be recognized by its very peculiar angulate appearance, due to the unusual elevations on the first and eighth abdominal segments and to the slender anal prolegs, which are produced posteriorly. The strange effect is further hightened by the caterpillar's habit of carrying its posterior extremity in an elevated position. The young larvae are variably marked with yellow, yellowish orange and lilac or purple, and in the earlier stages the angular projections are comparatively much greater than in the full grown larva.

Description. The parent insect is a pretty yellowish, rosy marked moth having a wing expanse of about one inch. The yellowish forewings are marked with pink as follows: an angulate line near the base of the wings, a short, oblique one near the middle, a wavy, subterminal one and the outer edge of the wings. The hind wings are either unspotted or with a pink line along the edge.

The color scheme of the nearly full grown larva has been given by Dr Packard as follows:

The body is now a deep delicate pea-green, with a large reddish brown triangular patch extending from the prothoracic segment next to the head and ending at the anterior base of the tubercles on the first abdominal segment. Behind the said tubercles a broad reddish brown patch extends to the large tubercles on the eighth segment, the band being edged with whitish yellow; from the rear of the tubercle a similarly colored band extends

to the end of the suranal plate. The underside of the body in front and the middle abdominal legs are brownish.

Green oak caterpillar

Nadata gibbosa Abb. & Sm.

A pale greenish caterpillar about ½ inch long, with a more or less distinct yellowish lateral line, occurs on oaks and various other trees in midsummer.

This leaf feeder is rather common though rarely abundant. The larva is a pale green form not easily separable from several species having similar habits.

Description. The full grown larva has been described by Dr Packard as follows:

Body green, large; head very large, full, rounded, high toward the vertex, as wide as the body, deep pea-green; the labrum whitish green; mandibles bright yellow, tipped with black, making them very conspicuous. Body glaucous pea-green, thick, full, soft, tapering toward the end, and the surface with minute, raised, flattened more or less confluent granulations. A lateral yellow line formed of yellow, raised, flattened areas. Spiracles deep red. Supra-anal plate conical, flattened, apex much rounded, the edge colored bright yellow. The thoracic and abdominal feet pale pea-green; all concolorous. Length 33 mm, thickness 6 mm.

The moth is a light buff color and has a wing spread of a little over 2 inches. Near the basal third there is a dark brown, slightly curved line and an oblique one of the same color at the apical third, which latter is margined outwardly by pale yellow. Outer edge of wing with minute whitish scallops.

This species has been recorded on oak, maple, white birch and sugar plum. It has a wide range, extending from Maine and Canada to Oregon and California, southward to the Atlantic and Gulf coasts.

Io caterpillar

Automeris io Fabr.

A large, greenish, stout caterpillar with fascicles of irritating, sharp spines over the body, feeds in late summer on the foliage of a number of trees.

This caterpillar with its light green body and delicate markings of yellowish red, is a beautiful creature. When full grown it is about 2 inches

long, light pea-green in color, with a magenta stigmatal band bordered below with creamy white. The body is clothed with spreading, black-tipped, delicate green spines. The moth has a wing spread of 2½–3½ inches and is easily recognized by the conspicuous purple-centered eye spots on the hind wings [pl. 43, fig. 1, 2]. The gregarious habit of this species makes its depredations more noticeable, though it is a very general feeder. It has been recorded by various writers on oak, elm, locust, maple, cherry, ash, beech, poplar, birch, black alder, sassafras and other trees and some herbaceous plants.

Definite marked tussock moth

Hemerocampa definita Pack.

A yellow-headed, light yellowish, tufted caterpillar closely resembling that of the white marked tussock moth, feeds on oak and a number of other trees.

This species is much rarer in New York State than the more common white marked tussock moth, Hemerocampa leucostigma Abb. & Sm., and the larva can be best separated therefrom by its yellowish head. It possesses about the same habits as its ally, and while Dr Thaxter gives oak as its food plant, Dr Dyar states that in practice he has found this caterpillar as omnivorous as its more common, closely related ally. The full grown caterpillar has been described by Dr Dyar as follows:

Male (6th stage). Head pale yellow, shiny, the labrum and antennae white; width 2.8 mm. Body pale yellow, a pale, almost colorless, dorsal band, replaced on joint two by the pale yellow cervical shield containing two darker yellow warts, narrow and greenish on joints three and four, widening and enclosing the yellow dorsal brushlike tufts on joints five to eight, narrowed on joints nine to 12 enclosing the concolorous retractile tubercles, and absent on joint 13. A narrow, subdorsal and fainter stigmatal, similarly colored line. These bands are in some specimens more or less blackish, or black, blue gray, or dark brown, and there is a velvety black spot between the dorsal tufts on joints six, seven and eight. The warts are all pale yellow; the pencils on joint two are long, plumed, black; that on joint 12 of light brown hair with a few long black plumed ones on its posterior side. The other hair is long, thin and white.

Female (7th stage). Head pale yellow minutely mottled with grayish spots; labrum, antennae and a spot before the eyes, white; ocelli and jaws

black; width 3.5 mm. The body is as in the previous stage, but the warts on the cervical shield are not distinctly darker. The dorsal blackish or pale gray shade is in tripiicate on joints three and four. Spiracles white in a fine black border. The body is often bright yellow, as are the dorsal tufts, and even the hair is yellowish.

Oak tussock caterpillar

Halisidota maculata Harr.

A black-headed caterpillar about 1¼ inches long, thickly clothed with yellowish hairs and black tufts of the same, feeds in September on a variety of trees.

The larva of this species has a decided preference for oak, though it has also been recorded as feeding on poplar, willow and alder. It may be recognized by its black head in conjunction with the thick covering of tufts of bright yellow and black hairs. The two posterior thoracic segments and the first abdominal segment are covered with mixed yellow and black hairs, those of the former overhanging the head. The first to eighth abdominal segments inclusive, bear a dorsal black tuft, the largest being on the seventh and eighth. There is also a black tuft on each side near the base of the first and eighth abdominal segments. The hairs of the second to seventh segments are bright yellow, while those on the ninth and tenth are mixed with black. The parent insect has pale yellowish wings mottled with dark brown, the hind wings being pale straw yellow.

Pale tussock caterpillar

Halisidota tessellaris Hübn.

A yellowish, brown-headed caterpillar about 1¼ inches long, clothed with delicate buff yellow hairs and with four light brown dorsal pencils of the same, feeds in the fall on a large variety of trees.

The larva of this species is a very general feeder, it having been recorded on about 30 trees and shrubs, representing 10 natural orders. It can hardly be considered a dangerous species, though exceptional conditions might enable it to multiply to an unprecedented extent. The larva has been described by Riley as follows:

The hairs delicate buff yellow; four dorsal pencils in front, of light

sienna brown, with two pairs of shorter lateral white tufts; a pair of whitish tufts near the end of the body; head yellowish brown; a row of lateral black spots above the base of the abdominal legs; length 30 mm.

The adult is a very pale yellowish brown moth [pl. 44, fig. 4].

Rusty tussock moth

Notolophus antiqua Linn.

A black-headed, yellow or white-tufted caterpillar with a lateral black hair pencil on each side, feeds on most deciduous forest trees.

This hair-tufted caterpillar resembles the much better known and very destructive larva of the white marked tussock moth, Hemerocampa leucostigma Abb. & Sm., and may be separated therefrom at once by its black head and from other allied forms by the presence of the lateral black hair pencil about midway of the body. This species has been received on several occasions from northern parts of the State, where it seems to be slightly more abundant than farther south. We have yet to learn of its causing serious injury. Dr Lintner records taking this species on low willows at Keene Valley N. Y.

Dark tussock moth

Olene achatina Abb. & Sm.

A black-headed caterpillar clothed with grayish hairs and with two black hair pencils on the second segment, and square tufts on segments five to 12, feeds on various deciduous forest trees.

This species is allied to the rusty tussock moth, Notolophus antiqua Linn. and has somewhat similar habits. It has been recorded as feeding on oak, hickory and wild cherry, while Dr Smith states that in New Jersey its larva occurs on the usual orchard trees and also oak, hickory and chestnut.

American dagger moth

Apatela americana Harr.

Large caterpillars thickly covered with yellowish hairs and bearing a pair of long black hair pencils on the first and third abdominal segments and a single one on the eighth, occur in September on a variety of trees.

This is one of our rather common caterpillars. It is a quite general feeder, having been recorded as living on maple, elm, chestnut, linden, oak, hickory, ash, sycamore, poplar, birch and alder.

The full grown larva is about 2½ inches long, thickly covered with short pale yellow hairs and bears a pair of long black hair pencils on the first and third abdominal segments and a single one on the eighth. The head is black, the body greenish white above with a subdorsal and stigmatal black line, venter black.

American lappet moth

Epicnaptera americana Harr.

A grayish, scarlet-marked caterpillar about 2½ inches long, remarkable because of the large bordering fringes on each side, occurs in September on oak, ash and apple.

This caterpillar is peculiar on account of the prominent depressed lappetlike fringes on each side which, when the larva is at rest, touch the bark and harmonize therewith so closely that the insect usually escapes detection. This species is never abundant enough to cause injury. The larva has been described by Harris as follows:

Body large, broad, and flat, with hairs on the side spreading out so as nearly to conceal the feet, the hairs arising from large lappets hanging from the side of each segment, the first pair the largest; upper side of the body gray, variegated with irregular white spots and sprinkled with fine, black dots; in front are two transverse velvetlike bands of a rich scarlet color, with three black dots on each band; underside of the body orange-colored with a row of diamond-shaped black spots; length 2½ inches.

American silk worm

Telea polyphemus Hübn.

A very large, pea-green, brown-headed, fleshy caterpillar with small, reddish brown tubercles with silvered bases, occurs in midsummer on the foliage of a great variety of plants.

This, one of the largest of our native caterpillars, is frequently known as the American silk worm on account of its dense silken cocoon, and various attempts have been made to use the silk in a commercial way. It, like other large forms, is not abundant as a rule, and only under exceptional conditions does it become destructive. The nearly full grown caterpillar is a beautiful object with its reddish brown tubercles silvered at the base and ornamented at the tip with white hairs. These present a striking contrast to the delicate pea-green color of the body. The head is a dull brick-red and the anal plate is margined with maroon. The spiracles or breathing pores are a delicate salmon color and the thoracic shield may be bordered anteriorly with yellowish green.

The adult is a dull ocher yellow moth with its wings, shaded with innumerable black particles, extending 5½ inches from tip to tip. The larva may be found on a considerable number of food plants, it having been recorded by various writers on oaks, hickories, black walnut, chestnut, elms, maples, poplars, willows, birches, witch-hazel, linden, and a number of other plants. It is never abundant enough so that repressive measures are necessary to prevent serious injury. The moth is illustrated on plate 42, figure 1.

Luna moth

Tropea luna Linn.

A stout, apple-green caterpillar about 3 inches long, with six rows of small, pink, hair-bearing tubercles, occurs in midsummer on a variety of trees.

This giant caterpillar is never present in numbers sufficient to cause material injury, yet the large size and exquisite beauty of the adult makes it an object of general interest. The larva is a general feeder, having been recorded on walnut, hickory, oak, butternut, chestnut, sweet gum,

birch, willow, beech, plum and ironwood. The full grown caterpillar is pale green shading into darker yellow, with yellow spiracles. There are six rows of small, pink tubercles, each with one or more black hairs and a few white hairs, some clavate, are scattered over the body. The anal shield is brown, triangular, yellow-bordered and the anal plates are brown bordered anteriorly with yellow.

The adult, a magnificent light green, long-tailed moth with a wing spread of about 4 inches, may be instantly recognized by reference to plate 41, figure 2.

Spiny oak worm

Anisota stigma Hübn.

A bright, tawny or orange-colored caterpillar with a dusky stripe along its back and prominent spines on its thoracic segments, feeds on oak in September.

This species is a rare one in the Northern States, though in the South it is frequently as destructive as our more common orange-striped oak worm, A. senatoria Hübn., to which it is closely related in structure and food habits.

Slug caterpillars

Peculiar, brightly colored, variously shaped and usually motionless sluglike caterpillars occur in midsummer on the foliage of various deciduous trees.

This group comprises a number of very interesting caterpillars remarkable because of the apparent absence of legs and on account of their brilliant color in connection with a more or less well developed defensive armor. These species vary widely in appearance, occur on a large number of trees and shrubs and are very rarely abundant enough to be regarded as anything more than natural curiosities. Some of these remarkable forms sting severely and occasionally call attention to themselves in a very unpleasant manner. It has been questioned some whether the sting is more than a mechanical one due to the insertion in the flesh of multibarbed spines, and in some instances, particularly with slug caterpillars, it would appear as if such might be the case. Glands at the base of the spine have been detected by European investigators who state that the hollow spines may be filled with formic acid or a formate in solution. Still, careful investiga-

tions of the urticating spines on the brown tail moth larva, Euproctis chrysorrhoea Linn. failed to detect a poison. A number of these peculiar larvae are oval in shape, with the flattened surface closely appressed to the leaf, giving them the appearance of brightly colored, very large scale insects or slugs. The general appearance is not at all suggestive of their natural affinities. A few representative forms are noticed briefly.

The **hag moth caterpillar,** Phobetron pithecium Abb. & Sm., is a brownish, sluglike caterpillar about ¾ inch long and with from a few to 10 long, plumelike processes extending from either side of the back. It occurs from July till September on the foliage of a number of trees and occasionally is somewhat abundant. Specimens were sent the writer in August 1902 with a statement that it was so numerous at Westwood N. Y. as to destroy the leaves of several large maple branches. This larva is supposed to sting severely, yet Miss Emily L. Morton has handled dozens of them and states that she has met with no injury therefrom. This slug caterpillar occurs on various low shrubs and the lower branches of trees, having been recorded on various oaks, chestnut, ash, apple, cherry, plum, sugar maple, sassafras, witch-hazel and dogwood.

The **saddleback caterpillar,** Sibine stimulea Clem., is another common slug caterpillar and a very striking species. It is a brownish caterpillar about 1 inch long, apparently with a green saddlecloth on its back and a brownish saddle, the latter margined with white and edged with a black line. Both the anterior and posterior extremities are adorned with long, brown, spined tubercles. This striking larva is capable of inflicting a very severe sting. It occurs commonly on oak and cherry.

Another striking species, Euclea indeterminа Boisd., is about ⅝ to ¾ inch long when full grown, oval in shape, with a series of six fiery red lines along the back on either side. It is banded with red, lined with black and with pale yellow and white markings. This larva feeds on various low bushes and limbs of trees, having been recorded from wild cherry, oak, hickory and bayberry.

Another type of slug caterpillar, Euclea delphinii Boisd., when

full grown is about ½ inch long. It is oval in shape, closely appressed to the leaf, greenish and variably marked with red and pale orange, the latter forming a pair of subdorsal stripes, in the course of which there may be bright red blotches. Tubercles short and bearing numerous short spines. This interesting caterpillar occurs on oak, chestnut, huckleberry, Andromeda, beech, sour gum, wild cherry and probably other deciduous trees.

The life history of this group has been the subject of careful and painstaking study by Dr Dyar, and those interested will find his biologic and bibliographic accounts given below of extreme value.

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Crinkled flannel moth

Lagoa crispata Pack.

A peculiar larva about 1 inch long, thickly covered with long mouse-gray and fawn-colored hairs, occurs on the foliage of various trees in September and October.

This species is an interesting form because the larva possesses 14 abdominal legs and is very similar in habit to the allied slug caterpillars, and like some of them, may inflict a severe sting. The larva rests flat on the surface and appears for all the world like a bunch of hairs. It has

been recorded as feeding on oak, elm, apple, raspberry and common brake, Pteris aquilina. Dr Smith states that it lives on most of the orchard trees and small fruits as well as many other trees and shrubs. Occasionally it is common though not destructive. The full grown larva ranges in length from about $\frac{3}{4}$ to $1\frac{1}{4}$ inches. The body is short, broad and flat and the head a deep honey-yellow. The caterpillar is so densely covered with long hairs that it appears about one half as long as broad and rounded at each end. The hairs on the thoracic segments are mouse-gray, those on the remainder of the body are pale fawn brown, sometimes dark reddish orange.

Filament bearer

Ania limbata Haw.

A slaty brown measuring worm about $\frac{3}{4}$ inch long, remarkable because of the two pair of dorsal filaments near the middle of the body, occurs in June on oak, maple, currant and strawberry.

This larva is a rather rare one and is noted in this connection because of the peculiar dorsal filaments which at once excite the curiosity of the observer and afford an easy means of identifying this species.

Archips fervidana Clem.

Black-headed, yellowish green caterpillars occur in thick web nests on scrub oak in early June.

This species, kindly determined by Prof. C. H. Fernald, was common in June and July 1901 on scrub oaks at Karner. It was rarer in 1902, indicating a considerable fluctuation in numbers.

Description. The larvae are nearly 1 inch long with the head and thoracic shield jet-black and the body varying in color from yellowish to olive-green. The dark brown tubercles are inconspicuous. The larvae spin scanty cocoons in their nests, the meshes entangling a mass of excreta.

The pupa is about $\frac{3}{8}$ inch long, dark green, ringed with lighter brown, and each segment bears a conspicuous row of stout spines with another row of smaller ones behind.

The adult has reddish brown fore wings, which are rather clouded with

fuscous beyond the middle. The posterior wings are dark fuscous above, pale yellowish beneath. Wing spread about 1_2 inch.

Life history. The nests of this species began to appear June 13, 1901, and were common on the 26th and later. Inhabited webs were also taken July 27 and others Aug. 9. The period of flight is probably extended and the insect appears to breed more or less during the summer months. The web is rather small, irregular, measuring 3 to 4 inches long and 2^1_2 to 3 inches in diameter. It is filled with a mass of excrement, as in allied species. A number of small, dark colored caterpillars about $^2_5$ inch long were observed in the nests after most of the moths had appeared. They closely resemble full grown larvae and may have been retarded individuals. Unfortunately none of the latter were brought to maturity.

Natural enemies. This species is preyed on by several parasites. Microcentrus delicatus Cress. and M. solidaginis Cress. MS., have been reared from this insect. Several parasites were bred from this species and a plant bug, probably Podisus placidus Uhl., presumably preys on the larvae.

V-marked leaf roller

Archips argyrospila Walk.

Delicate green, brown-headed caterpillars about $^3_4$ inch long, feed on oak and other trees in early June and also in August or early September.

This species is very closely allied to the oblique banded leaf roller, Archips rosaceana Harr., and like it is a general feeder, having been recorded on oak, hickory, apple, wild cherry, rose, soft maple and elm. It lives between the webbed-together leaves and produces two generations annually, the moths of the first appearing the latter part of June or early in July. The larva has been described by Dr Packard as follows:

Color delicate grass-green, with a darker dorsal vesicular line, not polished, piliferous spots polished; head brown, cervical shield polished, glasslike, and scarcely darker than body; anterior edge lighter. Thoracic legs pale.

Red-banded leaf roller

Eulia triferana Walk.

A small, light green, brown-headed caterpillar feeds in early June on the foliage of a considerable number of trees.

The larva of this red-banded leaf roller is a general feeder and has been recorded as depredating on oak, elm, apple, rosebushes, soft maple, cranberry and a number of herbaceous plants including some field and garden crops. Professor Slingerland records rearing a parasite, Urogaster canarsiae Ashm., from this species.

Tortrix albicomana Clem.

The larva of this species has been recorded on oak, rose and Aquilegia canadensis. The parent insect is a delicate moth having a wing spread of about 5/8 inch. The fore wings are pale brown diffusely marked with sulfur yellow. The hind wings are silvery gray.

Oak leaf roller

Tortrix quercifoliana Fitch

A grass-green larva about 3/4 inch long occurs during July in folded oak leaves.

This species, according to Dr Fitch, may be found within oak leaves which are curved upward and drawn slightly together by silken threads. It is a rather slender grass-green leaf roller, which pupates in the end of the leaf, the moth appearing in New York about the first of July.

White-blotch oak leaf miner

Lithocolletes hamadryella Clem.

Whitish, blotchlike mines on the upper surface of oak leaves, contain minute, footless, brownish and yellow larvae.

This species is one of our common leaf miners ranging from New York to Washington. Occasionally it is exceedingly abundant, particularly toward the end of the season, and the writer has taken oak leaves in Buffalo park, which were very seriously mined by this insect. Professor Comstock

states that there are five or six generations annually in the vicinity of Washington. He recommends the collecting and burning of infested leaves before the insects escape.

Fitch's oak leaf miner

Lithocolletes fitchella Clem.

This species works in much the same way as the preceding, except that its tentlike mines occur on the under surface of the leaves and are visible on both sides. Professor Comstock states that it is a very common species on all kinds of oak at Washington and records the insect from Kirkwood Mo.

Walking stick

Diapheromera femorata Say

Green or brown, sticklike insects sometimes measuring, exclusive of the antennae, 3 inches in length, are more or less abundant in forests of deciduous trees in early autumn.

This peculiar insect is a rather common form, though it frequently escapes observation because of its general resemblance to a stick. The young are green and closely mimic the color of the surrounding foliage, while the adults as they age and the foliage turns, change from the green to brown and toward the end of the season mimic brown sticks. On this account, in particular, specimens arouse considerable interest in the mind of the finder, and requests for identification and a brief account of its life history and habits are not infrequently made.

Early history. This deliberate, slender insect appears perfectly harmless and as a rule it causes very little damage. Occasionally it becomes excessively abundant and has been known to strip large areas. Prof. C. V. Riley, in his report for the year 1878, gives several abstracts from published reports of about that date, which are of considerable interest, particularly as they relate to depredations occurring in New York State and vicinity. Mr G. C. Snow of Yates county N. Y., published in the *New York Weekly Tribune*, Nov. 11, 1875, the following:

I noticed about August 15th, in a reservation of young timber, mostly white oak and hickory, a few trees having the appearance of being burned

just enough to kill the leaves. On closer investigation I found many of these insects devouring the leaves. Later, I judge at least 25 acres were completely stripped of foliage; as much so as if fire had run through the wood and killed every tree. They seemed to have no choice as to what variety of timber they attacked. There were many in my peach orchard and lawn. On single trees, far removed from my timber lot, they were as thick as could well be, in many places in heaps. Fences adjoining the timber were fairly covered with them. They have been known for years in this vicinity, but were heretofore always considered harmless. From present appearances they are greatly to be feared as a scourge, consequently anything relating to them will be read with great interest. I hear from them in Florida but not in such numbers as here.

The same year these peculiar insects were exceedingly abundant and destructive in the vicinity of Ferrisburg Vt., as stated in the *Rural New Yorker* for Nov. 7, 1874. There were also serious injuries to forest areas in Pennsylvania. The above accounts relate to one of the unusual outbreaks frequently seen among insects, and as a rule this species may be considered comparatively harmless.

Description. The brownish, bean-shaped eggs, a little less than 1/16 inch in length, are dropped at random in the forest and remain unhatched over winter. The recently emerged young are nearly 1/2 inch long, exclusive of the antennae, and are then a pale yellowish green. The full grown adults have a body length of about 3 inches and the slender, tapering antennae extend forward from the head about 2 inches. The slender, long legs are attached to the anterior portion of the body and measure from about 1 1/2 to 2 inches in length. They are rather easily detached and as a consequence perfect specimens are somewhat rare. The female is easily recognized by her stouter form. This peculiar insect in nature has the habit of extending its anterior legs and antennae, clinging largely by the posterior and middle legs and in this way simulating the appearance of a twig very closely.

Life history and habits. The eggs are dropped at random among the trees and remain unhatched till the following spring. The young appear sometime during the month of May, and are general feeders, grow rapidly and attain maturity in early fall.

Food habits. This species seems to have a preference for oaks, though it is recorded as feeding on most deciduous trees.

Remedies. Being a leaf feeder it should be readily controlled by thorough spraying with an arsenical poison whenever such is advisable.

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Striped hickory caterpillar

Datana angusii Gr. & Rb.

Clusters of black, yellow-striped caterpillars about 2 inches long, occur on hickory, walnut and birch.

This species may be distinguished from the more familiar yellow-necked apple worm, D. ministra Walk., by the prothoracic shield being entirely black. It has very similar habits, though its list of food plants is more restricted. The parent insect is marked almost exactly like D. ministra Walk., differing in the dark smoky brown color throughout.

Yellow-necked apple worm

Datana ministra Walk.

Clusters of black, yellow-necked, yellow-striped caterpillars nearly 2 inches long, occur in midsummer on the twigs of a variety of trees.

This species is well known in economic entomology as the yellow-necked apple worm because of its depredations on this valuable fruit tree. It is however a general feeder, having been recorded on apple, pear, cherry, quince, linden, walnut, hickory, oak of various species, chestnut, beech, hazel, hornbeam, birch, locust and sumac.

Description. The full grown caterpillars are black, about 2 inches in length with a yellow thoracic shield and a series of four black lines on each side of the body. This species and its associates feed in clusters and have the peculiar habit of elevating both extremities when disturbed.

The adult insect is a reddish brown moth with a wing spread of about $1\frac{3}{4}$ inches. The fore wings are crossed by a series of four or five oblique

or curved brown lines, the outer margin being dark brown. The hind wings are pale yellowish brown.

Life history. The eggs are laid in June and the larvae are met with from August onward, the moths appearing the following May.

Butternut woolly worm

Monophadnus caryae Nort.

Large, flocculent masses on the underside of butternut leaves in midsummer, may conceal bluish, yellowish white sawfly larvae about ¾ inch long.

This species is rather rare and was brought to our attention on account of the woolly white covering of the caterpillars which, when they occur in masses, gives them a resemblance to anything else but insects. This species was taken in August 1902, on butternut at Nassau N. Y. The larvae rested so closely together that the woolly covering gave them the appearance of being a solid mass. These false caterpillars feed in company, devouring the terminal portion of the leaf, rejecting the midrib and usually a small portion of the basal part. Cast skins or exuviae were found on the older leaves and these were yellowish white, with the tip of the mouth parts and eyes a dark brown or nearly black.

Description. The nearly full grown larvae are about ½ inch long, with the head, thoracic and terminal abdominal segments pale yellowish white. The other body segments are bluish gray with a very narrow, interrupted black dorsal line. The woolly matter is excreted from the conspicuous transverse folds and appears in narrow bands about 1/32 inch wide. These develop rapidly and on larvae naked the previous night, had attained a length of 1/64 inch the next morning. These waxy filaments are pushed out and eventually are about ¼ inch long, giving a very peculiar appearance to the bearer.

The adult is a black, red-marked sawfly having a wing spread of nearly ½ inch.

Natural enemies. Numerous pupae of a species of Cratotechus were found on a leaf near the larvae of this sawfly, undoubtedly parasites of this species.

Typophorus canellus Fabr.

A small, roundish, brown and black marked or black beetle about $\frac{1}{4}$ inch long occurs on butternut, mountain ash and various plants in May and during early fall

This species is a variable one, as is illustrated by Dr Horn's key for the separation of 14 varieties. It has been taken by Mr Young on butternut, mountain ash and such low plants as strawberries in May, and on the heathlike aster, Aster ericoides, the last of August and the first of September. It eats irregular, oval or elongate holes in almost any part of mountain ash leaves and occasionally causes considerable injury. Mr Young is of the opinion that a similar form occurring on low plants, may be different from that met with on trees, though at present he is not able to detect constant differences. This species, according to Dr Horn, is widely distributed over the continent east of the Rocky mountains, occurring from Kansas to Texas, west through Arizona to Fort Yuma.



Fig. 135 Typophorus canellus, showing dark and light forms, much enlarged (original)

Green-striped maple worm

Anisota rubicunda Fabr.

A large, pale yellowish green larva striped with darker green, occurs in midsummer on maple trees.

This species is generally distributed throughout the State, though rarely abundant enough to cause serious mischief. The late Dr Lintner, however, records an instance of this larva occurring in large numbers in Monticello, Sullivan co., where it defoliated a number of soft maple trees. This species is much better known as a pest in the Western States, where it frequently strips the leaves from large numbers of maples. It feeds on the sugar maple as well as the soft maple.

Description. The larva has been described by Dr Riley practically as follows:

The recently hatched larva is yellow with a large, black head, the spines forming little black tubercles of nearly uniform size. The head is browner after the first molt and the spines and stripes of the full fed larva more apparent. The third stage is very like the fourth or last, except that the caterpillar is smaller. The full grown larva is an inch and a half long, pale yellowish green, longitudinally striped above alternately with eight very light yellowish green lines and seven of a darker green, inclining to black, with two slender black spines on the second segment behind the head, and two lateral rows of sharper, shorter spines. Head copal yellow; abdominal segments seven and eight a little dilated and rose-colored at the sides.

The moth is rose-colored, with the fore wings crossed by a broad, pale yellow band. The hind wings are pale yellow. The body is yellow and the underside and legs rose-colored. Wing spread about 2 inches.

Semilooper maple worm

Homoptera lunata Drury

A drab colored caterpillar about 1½ inches long, and with a large, orange, dorsal spot exposed at the juncture of the first and second abdominal segments when the body bends, feeds on maple, oak, willow and rose.

The caterpillar of this widely distributed species is seldom abundant enough to cause much injury. The larva is about 1½ inches long, drab colored, with indistinct markings except for the large, orange, dorsal spot exposed when the body is bent at the juncture of the first and second abdominal segments. On the eighth abdominal segment there is a pair of small, brown-tipped tubercles. The head is quite flat, sloping and irregularly marked with brown. The caterpillar when walking loops much as does a measuring worm and displays a marked tendency to remain quiet and rely on its protective color to escape injury. The parent insect is an obscurely brown colored moth having a wing spread of about 2 inches. Both the fore and hind wings are rather prettily ornamented with wavy dark and light brown bands or lines interspersed here and there with indistinct grayish markings.

The eggs of this insect are deposited the latter part of April and full grown larvae are met with in early June, moths appearing the latter part of the month and in early July. Larvae also occur in August and September,

the moths appearing in the fore part of November, some wintering in the pupa. There are probably two or three broods during a season.

Cecropia moth

Samia cecropia Linn.

A large, pale green caterpillar about 4 inches long, ornamented with conspicuous green, blue, yellow and red tubercles, feeds on the foliage of a large number of trees and shrubs.

The larva of this insect is very striking in appearance and were it at all abundant its voracious appetite would result in a great deal of injury. Ordinarily it is so rare that no repressive measures are necessary. The giant moth shown at plate 42, figure 2, is rather common, and of interest largely because of its immense size. This insect has been recorded on about 50 plants representing some 20 genera, the more important of which are the following: linden, maples, apple and pear, cherry, elm, birch, alder, willow and poplar.

Large maple spanworm

Sabulodes transversata Dru.

A large, slender-bodied spanworm about 1¾ inches long and marked with dark purple brown and reddish markings, occurs on maples in July

This species is rather common and typical of a large class of span or measuring worms, which may be instantly recognized by their peculiar looping walk and their tendency to remain motionless on twigs when discovered. There are a great many species and almost all are so shaped and colored as to closely resemble the twigs on which they occur.

The larva of this species has the body thickened behind and ridged on the sides. It is a dark purple brown mixed with reddish and has a dull reddish gray crescent-shaped spot on the middle of the fourth abdominal segment, behind which is a pair of low kidney-shaped tubercles, and a pair of dorsal pointed black ones on the eighth abdominal segment. The parent insect is a yellowish tawny color with a dark brown oblique stripe extending from the apex of the fore wings to the middle of the anal margin of the hind wings. Wing spread about 2 inches.

Maple leaf stalk borer

Epinotia claypolcana Riley

Small, yellowish caterpillars nearly $^1/_2$ inch long, in midsummer bore the leaf petioles of maple and buckeye.

The work of this insect in maple leaf stems was brought to the notice of the late Dr Lintner in 1895, through specimens received from Concordsville Pa. The first indication of trouble was the apparently causeless dropping of leaves, and on examination a small caterpillar was found boring within the portion of the leaf stalk remaining on the twigs.

Description. This yellowish borer is about $^2/_5$ inch long with smooth, minute granulations on the skin, not pointed as in the case of another borer, Proteoteras aesculana Riley, which works in a similar manner. The adult is a small moth with a peculiar hopping flight. The fore wings are mottled with black and white and the hind ones are a nearly uniformly dusky color, slightly spotted with black near the tip.

Life history. According to Professor Claypole, the larvae occur in the early part of May, and about the 10th desert the leaf stems by the holes through which they have entered and migrate to the fading leaves on which growth is completed. Transformation to the pupa occurs within a rolled silk-lined leaf the latter part of May, the moth appearing about 15 days later. This species also works in the leaf stalks of the buckeye. The portion traversed by it shrivels, blackens and is soon broken off by the weight of the leaf.

The larva of another moth, Proteoteras aesculana Riley, also works in the leaf stalks of both buckeye and maple and extends its tunnels for a distance of about ½ inch to 2 inches into the slender terminal twigs of both these trees, often causing a pseudogall. The maple leaf stalk borer seldom or never bores along the leaf stem more than ½ inch, very rarely enters the terminal twigs and lives in the rolled-up leaf after the first two or three days.

Remedial measures. This insect, where abundant, can probably be

checked by collecting and burning the fallen leaves. Possibly it would be amenable to arsenical sprays were they applied early in the season.

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Maple leaf cutter

Incurvaria acerifoliella Fitch

Maple leaves with irregular, oval holes $\frac{1}{16}$ to $\frac{5}{16}$ inches in diameter may have been injured by this species.

This peculiar leaf feeder is occasionally rather abundant on maples in the eastern part of New York State. It is particularly common in the forests, and in May 1850, according to Dr Fitch, its work was so prevalent as to attract popular notice. Dr Fletcher of Canada records an instance of severe injury in 1885, stating that the foliage on four acres was almost entirely consumed, the flat, disklike cases of the larvae carpeting the ground and occurring in great numbers on the tree trunks. Some beeches were also attacked after the maple foliage had been devoured.

Description. The moth has a wing spread of about $\frac{1}{3}$ inch, with the fore pair a brilliant steel blue, sometimes bluish green with purplish reflections. The hind wings are a pale smoky brown, translucent, with pale blue and purple reflections and a pale brown fringe. The top of the head bears a tuft of erect, bright orange hairs, the thorax is a brilliant steel blue and the abdomen a dark satiny brown.

The full grown larva is about $\frac{1}{4}$ inch long, slender, flattened, cylindric, with slight constrictions marking the segments. It is a dull white with the head and three thoracic segments a pale rusty brown and an interrupted broad dorsal stripe.

Remedies. This species can probably be controlled by timely spraying with an arsenical poison.

Hylotoma scapularis Klug.

Yellowish, black-spotted, caterpillarlike larvae nearly $^{3}/_{4}$ inch long, feed on the foliage of American elms in August.

This species has been studied by Mr J. G. Jack of Jamaica Plain, and his description of the larvae and account of their habits follows:

The full grown larvae have a pretty general resemblance to those of H. pectoralis Leach and are about 18 mm long. Head light orange yellow, body somewhat flattish and light yellowish green in color. There are six distinct rows of small closely adjoining black spots on the upper portion of the body extending from the head to the anal segment. On each of the fleshy projections on the sides of the segments, except the last, there is an oblong dark spot; but these spots above the two posterior pair of true legs appear as two large somewhat triangular black blotches. Above the anal segment there is a large oval shaped black spot. The legs are black on the outer side, and the prolegs are marked by a dark brown blotch on the outer side. The black legs and black blotch on the anal segment are the chief marks which distinguish this larva from that of H. pectoralis in which the legs and anal segment are yellowish. The cocoons are of a dirty white or light brown color and average about 12 mm in length. They are composed of two walls, the inner being closely, and the outer loosely spun.

The eggs are deposited along the margins of the leaves of the common American elm (Ulmus americana) on which the larvae feed. Young larvae were found early in August and those observed attained full growth about the end of the month. Two males and many females were raised from these about the first of July following.

Alder leaf beetle

Chrysomela scalaris Lec.

A brilliant, bottle-green, oval beetle about $^{1}/_{3}$ inch long, with silvery white wing covers, the latter ornamented with several conspicuous green spots and with a median jagged stripe of the same color down the back, feeds on the leaves of elm, linden, willow and alder throughout the season.

This, one of the prettiest of our native beetles, sometimes becomes excessively abundant, and Dr Hagen records an instance in 1884, when this insect was very abundant on elms in Cambridge, and in 1881 it was so

numerous at Brunswick Me., as to seriously injure lindens on the campus of Bowdoin College, according to Dr Packard. Dr Fitch states that this species feeds on elms throughout the season and is also common on willows.

Description. This insect has been described in its various stages, by Dr Packard as follows:

Egg. Rather large, oval cylindrical, yellow, several together attached by one end; about 1.5 mm in length.

Larva. Body very thick, curved up like that of the grub of the Colorado potato beetle, being much swollen behind the thoracic segments, while the tip of the abdomen is curved down. Head honey-yellow, darker over the jaws; antennae bluish, except at base; eyes black. Prothoracic shield blackish in the young before the last molt; in full grown individuals not all black, but pale, with four irregularly square black spots. Body behind dirty white with a row of dorsal and lateral dusky spots. Legs pale, spotted with black at the joints. A pair of mesothoracic spiracles, and eight pairs of smaller abdominal ones. Low down, on the sides of the second and third thoracic segments a curvilinear black spot. Length, 8 to 9 mm.

Pupa. Body pure white; prothoracic shield with long scattered hairs around the edge and in two groups on the back; antennae curving around between the eyes and jaws, and with the ends resting on the tips of the elytra. The insect undoubtedly descends into the earth to pupate.

Beetle. Head, prothorax, and underside of body dark coppery green, with scattered pits. Antennae, palpi, and legs pale pitchy yellow; elytra coppery green and whitish, the green forming a broad median stripe, sending prolongations outwards toward the middle of the elytra, the first pair of branches nearly parallel to the band, the second becoming more and more at right angles to the band, the last short and broad near the tip of the body. Eleven rounded dark green spots in the whitish field; the pair near the shoulders gourd-shaped; two of the spots behind the middle of the elytra touching each other. The pits or punctures near the sutures of the elytra arranged in three lines parallel to the median line of union of the body; elsewhere they are arranged irregularly.

Life history. Dr Packard states that the beetles may be found abroad from May to June and that a second brood occurs in September and October. The grubs hatch from eggs deposited on the leaves in the spring, attaining full growth toward the end of June in Massachusetts. The transformation of the adult is believed by Dr Harris to occur in the ground. Among natural enemies, Dr Hagen records *Podisus spinosus* Dall.

as preying on the larvae of this leaf feeder. This species has an extended distribution, ranging, according to Linell, from the East to Nebraska and Texas.

Remedial measures. There is no reason why this species, when abundant, can not be controlled as in the case of other leaf feeders, by thoroughly spraying the infested foliage with an arsenical poison, preferably arsenate of lead.

Conotrachelus anaglypticus Say

A small, long-snouted weevil about 3/16 inch long, with strongly ridged elytra and prettily marked with dark brown, yellowish white and reddish brown (the latter forms a large spot near the anterior lateral margin of the elytra and nearly covers the posterior fourth) occurs on elm.

This species was taken by Mr Young, at Poughkeepsie, June 5 and 6, on slippery elm. The occurrence of the weevil on two successive days on this tree, would indicate a certain attraction for this food plant. The tree had been stripped of bark and the surface was dry though the leaves were green. Mr Young has also taken this species in the Adirondacks. Say records taking many specimens on a hickory, and states that they oviposit in the fruit. This species has been recorded by Dr LeConte, as abundant from Massachusetts to Kansas, Georgia and Texas. It has been listed as occurring on walnut throughout New Jersey, and Ulke states that it commonly occurs in the District of Columbia, under moist bark and on various bushes. Dr Horn records it as common in southwestern Pennsylvania, and Dury has listed it from the vicinity of Cincinnati.

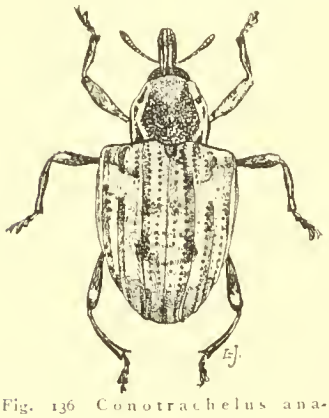


Fig. 136 Conotrachelus anaglypticus, enlarged (original)

Violet tip

Polygonia interrogationis Fabr.

A red-headed, black-spined caterpillar about 1 inch long, feeds on elm foliage.

This species is one of our common butterflies and occasionally its larvae become somewhat abundant and destructive to elm. It is easily

controlled by thorough spraying with an arsenical poison. The larva is more or less variable in coloration. It has been described as follows by Professor Fernald. The full grown larvae "are about an inch and a half long, pale yellow, variegated with brown, with a yellowish line on each side of the body. The head is rust-red, with two blackish, branched spines at the top. The spines of the body are arranged in seven rows, one along the middle of the back, from the fourth to the 11th segment inclusive and three rows on each side."

This insect, as do some of its allies, hibernates in the adult and under favorable conditions produces two generations. The butterflies of the first brood appear early in May and disappear by the middle of June. The larvae attain their growth rapidly and appear as butterflies in July, continuing on the wing till nearly the middle of August, depositing eggs late in July and during August, which produce butterflies again toward the end of August. Mr Scudder states that there are at least three broods in the South, and Mr Edwards thinks that there may be four or five in Florida.

Hop merchant

Polygonia comma Harr.

A yellowish, spiny, black-marked caterpillar about an inch long, feeds on elm.

This species closely resembles the preceding and according to Dr Packard, the larva differs in being brownish red anteriorly and white or pale yellow behind. It has been described by Professor Fernald as follows:

The mature larva is one inch long, armed with seven rows of long, tapering spines; one along the middle of the back, from the third to the twelfth segment, inclusive, and three along each side; the upper row on each side running from the third to the twelfth segment; the next row from the third to the thirteenth, but the spine on the fourth is below the row and in line with the spiracle; the lower row extends from the fifth to the twelfth segment. A little below the summit of each spine, from three to five branches start out, each branch and spine ending in a bristle. The color varies greatly; some are black with yellow bases to the spines and a yellow lateral line; others are nearly white, with red spots along the sides.

Its life history and habits are very similar to the two preceding, and

when abundant it can be controlled in the same manner. This species is one of the forms so well known as hop merchants, the hop being its favorite food plant.

Gray comma

Polygonia progne Cram.

A brown-headed, yellowish brown, spiny caterpillar about one inch in length, feeds on elm.

This species, according to Dr Fitch, is the more common spiny caterpillar found on elm. He states that it is white mottled with gray. It has been described by Professor Fernald as follows:

The mature larva is about one inch long, buff-colored, and armed with branching spines as in P. comma Harr. Head subcordate, with a large, compound, spinous process on each vertex, the main stem black, the branches black and yellow, the face and sides of the head thickly covered with simple, conical, yellowish spines of various sizes. The surface of the body varies greatly in color and markings.

The life history is very similar to the preceding and it can be controlled in the same manner.

Four-lined sphinx

Ceratomia amyntor Hübn.

A stout, pale green or reddish brown larva about 3 inches long, with a conspicuous caudal horn and four large tubercular elevations on the thoracic segments, occurs in early September on elm, beech, linden and probably ash.

This striking and to some disgusting larva is not uncommon in early September, and on account of its peculiar appearance attracts more or less notice, though it is rarely abundant enough to cause material injury to trees on which it feeds. The recently hatched pale green larva emerges from a spheric, greenish egg and is then about 1/5 inch long. It has a straight, brown-tipped caudal horn about half the length of the body and there are four minute, tubercular processes on the posterior thoracic segments. These latter structures continue throughout the different stages and afford a ready means of identifying the larva which, when full grown, ranges from 2¾ to 3¼ inches in length. It is then pale green or reddish brown with the head and body strongly granulated. There is a dorsal row of fleshy teeth,

one on each wrinkle, tipped with whitish or pink and extending along the abdominal segments. The two posterior thoracic segments are each ornamented with a pair of straight tuberculated horns, a line of granulations connecting them. Seven oblique stripes of whitish granulations occur on each side, each reaching from one segment across the following and onto the third, the last stripe extending to the caudal horn. The parent insect is a magnificent sphinx moth with a wing expanse of about 5 inches. The fore wings are broad with a large, distinct, round discal spot, light brown and variously marked with dark brown. The abdomen is marked with a narrow, black, dorsal line, a crenulate black, subdorsal line and a somewhat broken, black, lateral line.

Spring canker worm

Paleacrita vernata Peck

Dark striped measuring worms about an inch long, defoliate apple and elm trees in early spring.

This species is a well known apple pest in New England and inflicts considerable loss in certain portions of New York State. Its original food plant is the elm, and occasionally it is somewhat injurious to this, though most of the injury in later years has been in apple orchards. The fall canker worm, Anisopteryx pometaria Harr., is a closely allied form possessing similar habits except that the adult is more likely to emerge and deposit its eggs in the fall, whereas the spring canker worm does not usually appear till very early spring. The eggs of both hatch about the time the leaves begin to appear, and where the pest is at all abundant defoliation quickly follows. The caterpillars complete their growth, forsake the tree and transform to pupae in the soil. This makes it possible to take advantage of the wingless condition of the female and injury can be prevented by employing a sticky band in early spring or fall as the case may be, or by thorough spraying with an arsenical poison.

Ash sphinx

Sphinx kalmiae Abb. & Sm.

A stout, apple-green caterpillar about 3 inches long, with seven oblique stripes on each side and with a light blue caudal horn, feeds on the leaves of ash, lilac and mountain laurel.

The parent insect is a very handsome hawk moth having a wing spread of about 3½ inches. It may be recognized by its narrow, yellowish brown fore wings margined on the outer part and posteriorly with brown. The head and thorax are chestnut brown on the top and whitish or yellowish along the sides. A pair of light brown stripes extend down the back and there is a series of five or six lateral transverse stripes on the abdominal segments.

The full grown larva is three inches long with a rather small, flat head of a clear apple-green color, yellowish on the sides and with a lateral black stripe. The body is apple-green in color, lighter above and darker on the sides. There are seven oblique stripes on each side, confined to one segment each, which are whitish through the middle, yellowish on the lower side and dark blue, almost black on the upper side. The caudal horn is light blue thickly studded with shining black tubercles, and is quite curved. The caudal shield and anal plate are yellowish green and dotted with small, black, elevated points. Spiracles, pale orange, their upper portion extending into the yellow of the bands. Legs, black and pearly at the base. Prolegs with two black spots on the outside separated by yellow, or connected posteriorly by a black line. *Fernald*

Wavy ash sphinx

Ceratomia undulosa Walk.

A variable, light green caterpillar about 1¾ inches long, with reddish legs and caudal horn and a series of seven oblique whitish stripes on each side of the body, feeds on the foliage of white and black ash, lilac and privet.

This leaf feeder is not abundant as a rule, and the parent moth is a magnificent insect having a wing spread of nearly four inches. It is rather prettily marked with various shades of gray and dark brown or black, the latter in more or less wavy lines at the base and near the apex of the fore wings. The young pale greenish yellow larvae emerge from pale green

eggs and are then about 1/5 inch long with a large, straight caudal horn pointing obliquely up and backward. After the first molt the seven oblique whitish stripes are visible, and in the next stage there is an additional series of reddish spots along the longitudinal whitish stripe.

Apatelodes torrefacta Abb. & Sm.

A pretty yellowish or whitish, long-haired caterpillar about two inches long, with three dark hair pencils along the median line, one each on the second and third thoracic and eighth abdominal segments, occurs in midsummer on various food plants.

This caterpillar is a rather general feeder, having been recorded on ash, wild cherry, willow, sassafras, alder, blackberry, bayberry, azalea, viburnum, hazel, ironwood and gall berry. It is clothed with long, yellowish hairs which bend backward and the body beneath is marked with yellowish white. The long, yellow hairs part along the median line, where there are also a few short black hairs, giving a distinct black marking. The eggs are laid the latter part of June, hatching early in July, the larva requiring about 30 days to complete its growth. A parasite, Eremotylus macrurus Linn., has been reared from this insect.

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Hylotoma macleayi Leach

Black-headed, yellowish green, black-spotted, false caterpillarlike larvae nearly 3/4 inch long, feed in August on chokecherry foliage.

This larva has been carefully described[1] by Mr J. G. Jack of Jamaica Plain, and his account follows:

Full grown larva from 15 to 18 mm long. Head black. Body flattish; pale yellowish green, with four distinct lines of black spots along the back extending from the head to the anal segment; and with some minute, less regularly arranged spots or dots along the sides above the fleshy projections which characterize larvae of this genus. Each fleshy projection bears a long narrow black spot. The anal segment is surmounted by a large irregular oval black blotch and is brown above the

[1] 1891 Psyche, 6 : 11.

anus. The legs are dark brown or black on the outer base and have a heavy black blotch at the base. The prolegs are marked on their outer side by a somewhat triangular, black or very dark brown spot. The cocoon is double walled, the outer wall being loosely woven and it is dull white or pale brown in color, and is from 12–14 mm in length.

The larvae were found in considerable numbers in the month of August feeding on the foliage of common chokecherry (Prunus virginiana) at Jamaica Plain Mass. From these larvae a number of female imagos were bred in the latter part of the following May.

Cherry leaf beetle

Galerucella cavicollis Lec.

A small red leaf beetle, about 1/5 inch long, eats in midsummer irregular round holes in the leaves of wild cherrytrees.

This little species is somewhat abundant in the Adirondacks on wild cherry, and was repeatedly observed by the writer in August 1900. It was so numerous that the foliage on many of the trees was badly riddled, and large numbers of the beetles could be collected with little trouble. This species has also been observed by Dr Lintner injuring cultivated cherry trees on several occasions.

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Apple tent caterpillar

Malacosoma americana Fabr.

Web tents in the forks of wild cherry and apple trees in early spring, are most characteristic of this very common species.

This caterpillar is well known because of the conspicuous and characteristic tents or webs it spins in the forks of wild cherry and apple trees. The full grown caterpillar is about two inches long and may be easily distinguished from the closely allied forest tent caterpillar, Malacosoma disstria Hübn., by its possessing a continuous white line down the middle of the back, whereas the forest species has a row of silvery white, diamond-shaped spots. This caterpillar has marked preferences for the

plants named above, though it has also been recorded as feeding on sugar maple, shadbush, mountain ash, thorn, rose, witch hazel, elm, oak, birch, willows and poplars. It is kept in check to a considerable extent by natural enemies, prominent among which may be mentioned the small plant bug, Podisus placidus Uhl. The writer has taken five from a single nest and observed six or seven on the outside of another.

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Cherry scallop shell moth

Hydria undulata Linn.

Brown, webbed-together leaves occur on wild cherry shoots in July and August.

This species is rather common and attracts notice because of the curious way in which the cherry leaves are fastened together, edge to edge, with the upper surface inside. The yellow, black-striped caterpillars occur within this cavity. It is seldom abundant enough to cause material injury even to its comparatively worthless food plant. This species has been recorded on willow by Dr Packard, though the larvae presented some differences from the typical form on cherry.

Description. The full grown caterpillars are about 3/8 inch long and have a dark amber head and thoracic shield. The body is a variable yellow, marked as follows: dorsally there are four approximately equal, somewhat broken yellowish white lines inclosing brownish yellow lines, and laterally there is a broad, jet-black stripe nearly continuous across the anal plate, venter yellowish white. True legs dark brown, prolegs yellowish, tipped with fuscous.

Life history. The larvae attain full growth early in August or September, enter the soil and transform to pupae within slight silk-lined cocoons where the winter is passed. The moths appear the following spring and deposit their eggs in an irregular cluster on the lower side near the tip of the branch, as recorded by Messrs Comstock and Slingerland.

Ugly nest cherry worm

Archips cerasivorana Fitch

Yellow, black-headed caterpillars about ½ inch long, web together chokecherry leaves in midsummer.

This common species is not of much economic importance because its attacks rarely cause material injury, since they are so largely confined to the comparatively valueless chokecherry. It occasionally feeds on the cultivated cherry. Dr Lugger states that this species is sometimes so abundant in Minnesota, that the larvae enclose entire trees with their webs. It is sometimes extremely numerous in the province of Quebec, though rarely causing material injury.

Description. The full grown larvae are lemon yellow, clothed with scanty, fine, yellowish hairs, and have the head, the prothoracic shield, the anal shield and true legs black, the mouth parts being brown.

The moths vary greatly in size, having a wing spread ranging from ⅘ to 1⅕ inches. The wings are broad, the outer edge being rounded toward the base and straight from the middle to the tip. They are crossed by irregular, wavy bands, alternately of bright ocher yellow and pale leaden blue. The yellow bands are varied with darker spots, the most conspicuous of which is placed on the outer margin of the tip, and from this spot a broader ocher yellow band extends toward the hind angle and curves thence to the inner angle. The hind wings and the entire under surface are pale ocher yellow.

Life history. The dense web nests of this species are rather common the latter part of June, the larvae transforming to pupae early in July The interior of the nest at this time contains large black masses composed of larval excrement, among which the larvae spin their cocoons and transform to pupae. The moths emerge during July, and prior to the disclosure of the adults, the pupae wriggle partly out of the nest, so that after the escape of the insects, empty pupal cases may be seen projecting therefrom. The eggs have not been observed. Professors Comstock and Slingerland are of the opinion that the eggs are deposited in clusters on a

twig near the end of the branch and remain unhatched till the following spring.

Natural enemies. This species is very subject to the attack of parasites, and we have bred from one nest a number of specimens of Macrocentrus solidaginis Cress. This and other species are undoubtedly of considerable value in keeping the pest in control.

Serica sericea Ill. was taken on alder at Karner June 8, 1902. It is common in Herkimer county on the blossoms of wild cherry, visiting these trees when in bloom.

Pteronus thoracicus Harrington

A greenish, solitary sawfly larva resting on its venter on the under surface of shadbush leaves (Amelanchier canadensis) may belong to this species.

This larva was met with by Dr Dyar at Plattsburg N. Y. and its various stages have been characterized by him as follows:

First stage. Head round, higher than wide, but not narrowing to vertex, shining, eye black, mouth brown; width .25 mm.

Second stage. Similar; eye surrounded by a black spot; head rather higher; width .33 mm

Third stage. Head almost whitish, pale; width .5 mm; joint 2 small, making the head appear prominent. Body much as in the following stages, but paler.

Fourth stage. As in the next stage in all points, but a little paler, though darker than in the previous stage; width of head .7 mm.

Fifth stage. Head round, smooth, shining, greenish testaceous, prominent; eye black, mouth brown; width 1 mm. Thorax a little enlarged, the feet spreading widely, not concealed. Abdomen slightly tapering posteriorly, gradually becoming smaller from the thorax; feet present on joints 6–11 and 13; segments 4-annulate, smooth, without tubercles, not shining; color pale clear green, the alimentary canal showing dark green or the surface covered with a slight white bloom. Thoracic feet watery greenish; abdominal ones short, concolorous with the pale subventral region; anal plate rounded.

Sixth stage. As before, width of head 1.4 mm.

Seventh stage. Head held forward; light testaceous, faintly brownish, smooth, shining, minutely reticulated; eye black, mouth brown; width 2 mm; joint 2 depressed anteriorly. All as in the previous two stages; skin smooth, but not shining; at the end of this stage the larvae fade to a whitish color with a bright green dorsal band and enter the earth without molting.

Cocoon double, the outer layer thin, brown, the inner dark brown, compact, but not very hard ; size 4 x 8 mm.

The adult female is about ¼ inch in length, reddish yellow with darker markings. The male is slightly smaller, black, marked with reddish yellow.

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Orange dog

Papilio thoas Linn.

A large, brownish caterpillar with conspicuous angular, cream-colored markings on its middle and at its posterior extremity, is sometimes rather abundant on prickly ash.

This species is southern and only occasionally is it abundant as far north as Albany, though it is quite common near Poughkeepsie and undoubtedly more abundant farther south. Dr Smith states that only single examples occur throughout New Jersey.

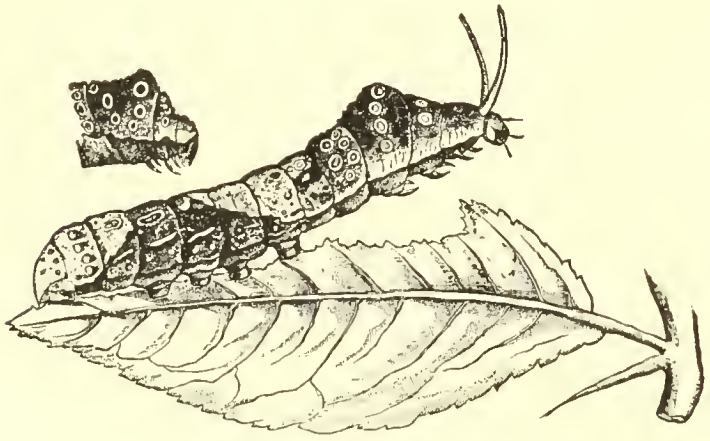


Fig. 137 Orange dog about natural size

Description. The full grown caterpillar is about 2½ inches long, dark brown in color with a conspicuous angular, cream-colored blotch about the middle and another similar colored area at the posterior extremity. The thoracic segments are slightly swollen and marked with several yellowish ocellate spots, so that when the head is drawn under the anterior thoracic segments there is a strong resemblance to a mask face. This caterpillar when irritated, as in the case of its allies, is capable of projecting two long, fleshy, orange-colored tentacles from a fold just behind the head. These emit a very disagreeable odor and are

probably of value in protecting the insect from its enemies. The parent insect is a magnificent brownish, yellow and red-marked butterfly with a wing spread of over 4 inches.

Life history. This insect, according to Dr Scudder, ranges from the northern part of South America to about the latitude of Albany, and in the warmer portions of its habitat develops about four generations and in the northern only two, the butterflies of the first appearing in early June or even the last week of May, and those of the latter occurring at the end of July. The caterpillar feeds on orange, prickly ash, hoptree and a number of other plants. The life cycle may be completed from within 20 to 60 days, dependent largely on conditions. A number of eggs are usually deposited on a single bush or tree and consequently the work of the larvae is easily detected.

Natural enemies. This species is subject to the attack of several natural enemies, among which may be mentioned a tachina fly, a small chalcid, Chalcis robusta Cress. and Pteromalus vanessae Howard.

Remedial measures. Like most leaf-feeding species, this caterpillar when unduly abundant, can easily be checked by the timely application of arsenical poisons.

Sour gum case cutter

Antispila nyssaefoliella Clem.

A small leaf miner works in sour gum leaves the latter part of August and in early September, cutting oval cases therefrom the latter part of that month.

This species is occasionally very abundant on Long Island, and in September 1893, it was brought to the attention of the late Dr Lintner by Dr Dyar, who had observed the work of this species.

Description. The larva has a dark brown head and thoracic shield, the body is a very pale green with dark atoms along the dorsum. Ventral surface with a line of two black spots. The adult has dark brown fore wings with greenish reflections and a bright coppery hue at the base. The hind wings are a purple brown, the fringe yellowish gray.

Life history. The larvae may be found early in July, making first a linear mine and later excavating a blotch. The cocoon is spun within the

mine, well lined with silk and the upper and lower walls composed of the leaf epidermis, is cut away so that the case with its occupant, drops to the ground. It is then secured to surrounding objects by small strands of silk.

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Red-footed flea beetle

Crepidodera rufipes Linn.

A red-headed, blue flea beetle about 1/8 inch long, is sometimes very abundant on locust and apple foliage.

Specimens of this little flea beetle were taken from badly damaged honey locust foliage at Poughkeepsie, May 21, 1903.

Description. 1/8 inch long, with head, antennae, legs and prothorax a brick-red color, while the wing covers are bluish and plainly marked with rows of punctures. The ventral surface of the meta- and mesothorax and abdomen black.

Life history and habits. This little insect is liable to appear in large numbers in early spring, at which time its depredations on locust, apple and other fruit trees may be somewhat serious. Dr Smith states that in New Jersey it also attacks grape.

Distribution. This is an European form, according to Dr Horn, now widely scattered over the Atlantic region and as far west as Iowa. It is probably generally distributed over this area, since it has been recorded in a number of local lists.

Locust leaf folder

Epargyreus tityrus Fabr.

Large, pale green caterpillars about 2 inches long, with a red neck and large red head and a yellow spot on each side above the mouth, draw the leaves of locust together and feed by night.

The caterpillar of this rather handsome butterfly is a somewhat general feeder, eating freely the leaves of many of the Leguminosae and occasionally being so abundant in New England as to strip the foliage from the common locust and specially the viscid locust, Robiniae viscosa,

which latter is used as an ornamental tree. Ordinarily it does not cause a great deal of injury. The parent butterfly is a beautiful orange-red, dark brown-marked butterfly with a wing spread of about two inches. The fore wings have a number of irregular black spots, the outer margin being a dull brown, while the greater portion of the short-tailed hind wings are dark brown, the prolongations and posterior margin being blue. Dr Scudder states that this insect produces two generations in the South and but one in the North, hibernating in the chrysalis. The eggs are laid during June or early July, the caterpillars hatching in the latter month, and when quite small conceal themselves in the leaf fold, which is bent over their bodies and secured by silken threads. As they increase in size two or more leaves are fastened together so as to form a leaf case, which shelters them from the weather and screens them from the prying eyes of birds.

Promethea moth

Callosamia promethea Drury

A large, delicate bluish white caterpillar with four large yellow or red tubercles on the posterior thoracic segments and a large one on the dorsum of the eighth abdominal segment, feeds on the foliage of lilac and a number of trees and plants.

This is another common species remarkable in its larval stage for the delicate color, which so closely resembles that of the underside of a lilac leaf, that the caterpillars are difficult to detect. The full grown larva is a stout, bluish white caterpillar about 2½ inches long and ornamented as described above. The parent insect is one of our larger moths and can be easily recognized by reference to plate 43, fig. 4. This species feeds on a number of trees and shrubs, being commonly found on lilac, and occurring on sassafras, wild cherry, oak, maple, birch, beech, apple, peach, plum, tulip, poplar and occasionally on pine.

Pristiphora sycophanta Walsh

A whitish, green tinted sawfly larva on willow, white and yellow birch belongs to this species.

This sawfly was found by Dr Dyar on the leaves of white birch at Keene Valley N. Y. and also on willow and yellow birch at Jefferson N. H.

The later stages of this sawfly have been characterized by Dr Dyar as follows :

Larva. Head whitish, scarcely shining, eye black, mouth brown ; a green tint by transparency ; width 1.5 mm. Body smooth, not shining, faintly 4-annulated, translucent, leaf-green, the pulsating edges of the dorsal vessel forming a geminate white dorsal line, filled in with the darker green blood, the anal end usually touched with crimson ; segmental incisures a little folded, forming transverse whitish bands when the segments are retracted ; tracheal line evident ; thoracic feet clear, moderately spreading, abdominal ones small, present on joints 6–11 and 13.

Last stage. As before, but the head is shining, with brown dots ; body also more shiny ; width of head the same as before ; the larvae form brown cocoons in the earth.

The female is $^{1}/_{5}$ inch in length, black marked with yellowish.

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Poplar leaf beetle

Phytodecta pallida Linn.

A pale brown, black-spotted beetle about $^{1}/_{4}$ inch long, is occasionally destructive to willow and poplar.



Fig. 138 Poplar leaf beetle, Phytodecta pallida, five times natural size. (After Chittenden, U. S. Dep't Agric. Bur. For. Bul. 49, 1904)

This species, according to Mr Chittenden, ranges across the continent from the White mountains of New Hampshire through the Lake Superior region, Wyoming and Utah to California and British Columbia. It has been observed in injurious numbers in Michigan, occurring in early June in such abundance as to skeletonize the leaves and inflict serious injuries to the trees. Its coloration is more or less variable, and like other leaf feeding insects, it may be controlled with arsenical poisons.

Viceroy

Basilarchia archippus Cram.

A somewhat tuberculate, angular, reddish brown, yellowish marked caterpillar 1 1/4 inch long, feeds singly on willow and poplar.

The parent insect is a very striking and common butterfly in the Adirondacks, having a wing spread of about three inches. It may be instantly recognized by the broad, oblique, white band extending across the middle of both the fore and hind wings. The caterpillar is rather curious in appearance and has a red or purplish brown head ornamented with many reddish brown tubercles. The thoracic segments are somewhat enlarged, dull dirty brownish yellow or clay brown and with darker markings. The middle segment bears a pair of long, spiny tubercles. The rest of the body is a dark brown, olive or dark reddish, tinged in places with brownish yellow, occasionally running into black, and on the middle of the back is a large saddle-shaped spot of a dirty dull cream color, usually slightly tinged with green. While this species is abundant in the Adirondacks, the caterpillars are rarely numerous enough to cause material injury. It feeds by preference on poplars and willows and it has also been taken on other trees such as apple, plum, cherry and it is said to occur on oak.

Harpyia cinerea Walk.

A peculiar, light green, brown-marked caterpillar with a pair of long, slender, annulated caudal appendages, occurs on willows and poplars.

This insect is interesting largely because of the very peculiar caterpillar which, when at rest, appears somewhat like a linear brown scar on a leaf. This peculiar form and coloration is undoubtedly a protective device. This species is so rare that it can not be considered dangerous. A male is represented on plate 44, figure 7. A larva, probably of this species, is illustrated on plate 16, figure 10.

Smeared dagger moth

Apatela oblinita Abb. & Sm.

A black-headed, velvety black caterpillar usually with a conspicuous, somewhat broken, subdorsal, yellow stripe and another one along the stigmatal line, occurs in September and October on poplar, willow, alder, buttonbush and a variety of deciduous trees.

This caterpillar is very common, though rarely abundant enough to cause material injury, partly because of its very general food habits.

The full grown larva has a black head, the body is velvety black mottled with yellow dots which, along the subdorsal line coalesce more or less to form a somewhat broken, subdorsal stripe. There is a broad, yellow, stigmatal band deeply incised at the white spiracles. The tubercles are black and bear short bristly hairs. There is more or less variation in color; the tubercles may be deep red, or situated in a series of broad, transverse, red bands reaching across to the spiracles on each segment. The yellow markings may be much more apparent, forming a broad and nearly continuous substigmatal band.

Poplar tent maker

Melalopha inclusa Hübn.

A black, yellow-striped larva, about 1¼ inches long, with a pair of large, black tubercles close together on the top of the first and eighth abdominal segments, feeds in the folded, webbed-together leaves of poplar and willows

The larva of this species is easily recognized on account of its remaining in an enclosure formed of several leaves fastened together at the ends of the twigs. It is gregarious in habit and ordinarily is not sufficiently abundant to cause material injury.

Description. The full grown larva is about 1¼ inches long with a nearly cylindric body, bearing on the first and eighth abdominal segments a pair of large contiguous black tubercles. The general color of the body is black, irregularly mottled with grayish white. There are four subdorsal, lemon yellow equidistant stripes, a substigmatal line of the same color and beneath, a broad, lemon yellow or orange band mottled irregularly with black and dark brown [pl. 16, fig. 1]. The second and third thoracic segments and abdominal segments one to eight inclusive, bear anteriorly a rather inconspicuous subdorsal, black setaceous tubercle between the sub-

dorsal stripes and larger supralateral ones on the middle of each segment. There is a more or less indistinct lateral, dark brown or black line bordered above and below by grayish or yellowish. The stripes above and below this indistinct line are lighter and irregularly mottled with grayish or yellowish. The true legs are jet black, prolegs dusky orange or yellowish.

The moth has a wing spread of a little over an inch, the fore and hind wings being pale gray, the latter sparsely marked with dark brown scales [pl. 16, fig. 2].

Life history. The eggs of this species, according to Riley, occur in April, May, July and August, the larvae from May to July and August to September, adults March, April, May and July and August. There are evidently two generations annually.

Pteronus mendicus Walsh

A yellowish, leaf-feeding species. This sawfly larva was taken on willow in Central park and also at Plattsburg by Dr Dyar, who describes its method of oviposition and early stages as follows:

Egg. Laid anywhere on the leaf in semicircular saw cuts just under the upper epidermis; cuts 1.5 mm in diameter.

First stage. Head blackish testaceous, shining, eye and mouth black; higher than the body; width .3 mm. Body indistinctly 4-annulate, not very shining, greenish. Thoracic feet and anal prongs blackish; abdominal feet on joints 6–11 and 13.

Second stage. Head dull testaceous, a blackish longitudinal line at the vertex, one upward from each ocellus; eye black, mouth brown; width .55 mm. Body dull greenish, thoracic feet concolorous; a faint blackish tinge above spiracles and a little on subventral ridge on joints 2–4, pale along dorsal line; posterior portion of the body curved under so as to touch the venter; anal prongs blackish.

Third stage. Head rounded, flattened before, pale green, faintly brownish tinged; a black longitudinal line over the vertex, reaching top of clypeus; a lateral transverse line over ocellus, not quite reaching vertex; mouth brown; width .9 mm. Body soft, leaf-green, a faint blackish dorsal and substigmatal shade line; venter a shade paler. Feet small, green; anal prongs blackish. Body scarcely annulate, not shining; tracheae showing as a white line.

Fourth stage. Head clear green, marked as before, the marks clouded, not so black as ocelli; an additional patch at apex of clypeus; width 1.15 mm. Body uniform leaf-green, not shining, except in the creases of the

annulets; feet clear, no marks; color paler, clearer greenish yellow than before, tracheae very distinct, white; annulets very obscure; anal prongs with a very faint blackish shade, a few setae on anal plate.

Cocoon. At first pale yellow, later brown, opaque. The adult female is about ¼ of an inch long, light yellow, marked with darker and with brownish antennae. The male is a little smaller, black, and marked with yellowish red.

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Pteronus odoratus Dyar

This species lives on willow and has been taken at Ithaca N. Y. The eggs and larval stages are characterized by Dr Dyar as follows:

Eggs. Laid in masses on the underside of a leaf, on the surface without any saw cuts. The dried, empty skins measure .8 x .4 mm.

First larval stage. Head .3 mm wide, rounded, shining black as in the next stage.

Second stage. Larvae eating holes in the leaf, near the eggs. Head rounded, full at vertex, black; width .5 mm. Body held S-shaped; thoracic feet blackish. Segments annulate shining greenish yellow, pale; the two rows of subventral tubercles visible, smoky; none seen dorsally. Anal plate small, black.

Third stage. Head as before; width .7 mm; anal plate and spines black. Lateral and subventral tubercles blackish; subdorsal black spots faintly indicated. Body light green; joints 2, 12 and 13 posteriorly yellowish. On approaching a group of these larvae on a tree, their peculiar odor is very obvious.

Fourth stage. As in the next stage, except that the black markings are smaller. Width of head 1 mm.

Fifth stage.. Head well rounded; clypeus large, quadrate, smooth, shining black, the sutures and antennae honey-yellow; width 1.4 mm. Body normal for Nematus, terminal segments somewhat swollen. Thoracic feet large, abdominal ones present on joints 6–11 and 13 (20 feet), the last pair small. Five medioventral eversible pale yellow scent glands behind the feet on joints 6–10. These function in the normal position of defense of the larvae when the abdomen is held up in an S-shape. A black anal plate with a pair of terminal spines. Segments 4–5 annulate, smooth, slightly shining, the tubercles obsolete dorsally, but represented laterally and subventrally by large, smooth, rounded, shining black prominences, largest subventrally. A dorsal and subdorsal row of round black spots with

irregular edges, four on each segment in a straight, even line, not shining like the subventral tubercles. Body light green; joints 2, 12 and 13 posteriorly orange. Venter orange tinted. Thoracic feet black, except at the joints; abdominal ones green.

Larvae entered the earth without molting and formed thin, elliptic black cocoons of uniform close texture. Size 6 to 7 x 2.5 to 4 mm.

The adult female of this species is nearly ¼ inch long; black, marked with dusky and ferruginous. The male is slightly smaller, black and marked with light yellowish, which is also the color of the venter.

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Willow flea beetle

Disonycha caroliniana Fabr.

A striped, rather stout, black and yellow beetle about ¼ inch long, occurs in June on willow.

This insect was taken by us in small numbers on willow and as a general thing it can hardly be considered injurious. Dr Walsh records rearing it from a cecidomyid gall, Rhabdophaga brassicoides, of the same season's growth, and states that he captured another at large on that gall about the same date. He also records, on the authority of Dr LeConte, that Say found this species in considerable numbers on the common elder (Sambucus) and some other plants, but he states that he failed to obtain any specimens on elder at Rock Island, though it is a common plant in that section. Dr J. B. Smith records this species from a number of New Jersey localities. Mr F. H. Chittenden obtained eggs of this species and succeeded in bringing the insect to maturity on purslane, though the larvae rejected chenopodium and amarantus. The eggs were obtained July 30, and the largest larvae had attained full growth by Aug. 9, and entered the earth the following day. The remainder buried themselves in the sand Aug. 11, and all but one had transformed to pupae on the 17th. He found the pupal stage to be of about nine days duration. He has described the larva and pupa as follows:

The larva when full grown is subcylindrical in form, abdominal segments 2 to 7 subequal in width, the others gradually narrowing toward the extremities. Ground color either olive or green, variegated with red, forming with a dark green mediodorsal and two submedial stripes, seven longitudinal stripes of alternate green and red. Sometimes red and sometimes green is the prevailing tint. Surface finely granulate, feebly shining. Aside from color the general characters are much the same as in D. xanthomelaena Dalm. . . Each segment is produced into a transverse row of 10 papillae, each surmounted by a small black piliferous wart, and terminating in a fine bristle. The first thoracic segment has an additional row of papillae, and each spiracle is surrounded by a ring of black. Head small, nearly circular, color shining black or very dark brown, triangular space in middle and clypeus brown. The posterior end of the body terminates in a proleg which is concolorous with the surrounding portions of the terminal segment. This is surrounded with two rows of black bristles, one above and the other below. Legs considerably darker than the neighboring portions; sutures and some other portions marked with black, last joint nearly black. Length 10 mm, width 3 mm.

From the variability in color of the larva we would expect a similar variation in the pupa. As with the larva there are two prevalent ground tints; in one, rose is the prevailing color; in the other, somewhat greenish orange. Probably these colors represent the similar colors in the larva, rose corresponding to red and orange to olive and green. Aside from color the pupa of this species closely resembles that of D. xanthomelaena. The pink or rose-colored form of the pupa has pearly antennae, elytra, and legs, while the orange type has orange-yellow as the color of the same parts. Length, 6–6.5 mm, width, 3–3.2 mm.

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Spotted willow leaf beetle

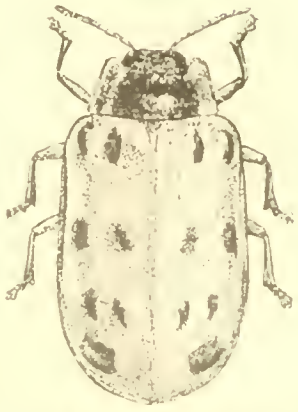
Melasoma lapponica Linn.

A reddish, black-spotted beetle about ¼ inch long, feeds during the summer on willow leaves.

This species is closely allied to the striped cottonwood beetle, Melasoma scripta Fabr., noticed on page 317, and it is stated that the

larvae of these two species cannot be separated, though the young of this form appear to excrete the milky fluid more freely than its ally. The parent insect may be recognized by its red color above and conspicuous black markings, and were it not for its rather elongated, pear-shaped form, it might be mistaken for a lady-beetle. This insect feeds on willows and poplars and apparently has very similar habits to those of M. scripta Fabr. Mr Chittenden states that in some seasons it is just as abundant as the more injurious cottonwood leaf beetle. Mr F. W. Hubbard recorded it as being destructive to willows at Lyons N. Y. in 1902. It has been reported as generally distributed in New Jersey by Dr Smith, who also gives alder as a food plant.





Remedial measures. This species, like its ally, is a leaf feeder and can be controlled by a thorough application of a poisoned spray.

Melasoma tremulae Fabr.

This species is very closely allied to M. scripta Fabr.

It may be recognized by its brownish, finely punctured elytra, and greenish head and thorax. This form is exceedinglyab undant and injurious in the northwestern states writes Dr Lugger, who adds that it sometimes strips the leaves from willows of Minnesota windbreaks. He ranks it as next to M. scripta Fabr. in economic importance. This species was taken by Mr D. B. Young at Newport N. Y. in 1898, where it was stripping the leaves from small poplars and willows.



Chrysomela bigsbyana Kirby

A yellowish, black-marked, hemispheric beetle about ¼ inch long feeds the latter part of the summer on willows and hard pine.

This leaf feeding beetle was taken on hard pine at Karner, September 1901, nine specimens being collected on the 6th, and two on the 17th.



Fig. 142 Chrysomela bigsbyana, enlarged (original)

This species is recorded by Walsh as feeding in the larval stage on willow. He states that the young resemble the grub of potato beetle. It has been described by Mr Coquillett as follows:

Body white, tinged with yellow; spiracles black with a white dot in the center of each; on each side of the segments 2 and 3 is a curved black dash, the curve downwards; cervical shield concolorous, marked with a blackish spot in the middle of each outer edge; head yellowish brown, ocelli black, in two clusters; length 10 mm.

Dr J. B. Smith states that this species occurs with C. multipunctata Say, on maple, willow, and alder, but that it is more rare. This form is regarded by some as a variety of C. multipunctata and is often confounded with it, so that many references to Say's species, in reality apply to this form.

Dull red willow leaf beetle

Galerucella decora Say

This is one of our most abundant leaf beetles and has been considered by Riley to be the most numerous and dangerous among our willow insects. It closely resembles the related, exceedingly destructive elm leaf beetle, Galerucella luteola Mull. Its eggs, according to Mr Chittenden, are a little larger, more brightly colored and less acuminate, and the young larvae are darker in color though very similar. He has observed this species on swamp willows in central New York in great numbers, both larvae and adults.

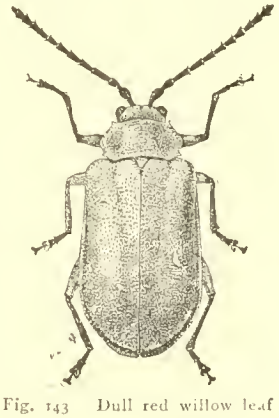


Fig. 143 Dull red willow leaf beetle, Galerucella decora, five times natural size. (After Chittenden, U. S. Dep't Agric. Bur. For. Bul. 46. 1904)

Anaspis flavipennis Hald. occurs abundantly on willow catkins and also on shadbush when in bloom.

Orchestes ephippiatus Say and **O. niger** Horn, occur on swamp willows in Herkimer county in May and June.

Rhynchites cyanellus Lec. was taken on willow at North Chatham, June 6, 1902.

Elleschus ephippiatus Say

A small, brownish, long-snouted beetle thickly clothed with golden and brownish pubescence, occurs in considerable numbers on willow in early spring.

This species was met with by us May 16, 1903, at Nassau, where it was abundant pairing and feeding at the base of the ovaries of willow blossoms. This insect appears to be limited to this food plant, since it has been taken on or bred from this plant by a number of entomologists. Dr Walsh reared this insect from a cecidomyid gall, R. brassicoides, on Salix longifolia, and Dr Hamilton records it as common on willow sprouts in southwestern Pennsylvania.

Description. The beetle may be recognized from the following description by Dr LeConte.

A small yellowish brown insect, densely clothed with yellow pubescence, with a large dark spot near the base and another transverse one behind the middle, connected by a sutural stripe; sometimes there is an appearance of a third spot near the tip of the elytra.

Dr LeConte states that this species might easily be confused with some of the varieties of Phyllotrox nubifer Lec., and adds that the elytra are less broadly rounded at the tip and the claws are not simple but broadly appendiculate. He states that it varies greatly in size, ranging from .07 to .11 inch in length.

Distribution. This species has an extended distribution. It has been recorded by Dr Dietz from the Atlantic States, Michigan, Georgia, Kansas, New Mexico and California.

Poplar sawfly

Trichiocampus viminalis Fallen

Orange-yellow, black-spotted larvae, about 7/10 inch long, feed side by side on the foliage of poplars in the early part of June.

This species was brought to notice by Dr J. A. Lintner, under the name of Aulacomerus lutescens as he was unable to refer it to any described species.

Life history. He states that he found a number of the larvae in the early part of June feeding in parallel rows side by side, on two leaves which had been eaten from the tips, downward. The scars made by oviposition were observed on the leaf stalks and on the leaves, 30 in the case of one, and 28 in the case of the other. He adds that both lots were probably deposited by one female. The larvae feed heartily, and when all but the basal parts had been eaten on one leaf it was abandoned for another. In some cases some of the larger veins were left uneaten. The larvae fed in company till mature, though as they approach this period, they separate into smaller groups and would at once do so if disturbed by the removal of some from the leaf. They commenced to spin irregular cocoons between the leaves on which they had been feeding June 25, and by the 27th all had spun up. The perfect insects appeared July 13 to 18. A second brood of this species was observed in August. A large number of leaf petioles bore the marks of oviposition, the eggs being placed in two parallel rows on opposite sides, usually on the upper side of the leaf stalk, the rows apparently being made one after another, as they were seldom of equal length, and each for the most part, having the punctures in a perfectly straight line. The foliage of the infested trees was so badly eaten that it was necessary to pick off such infested leaves as could be conveniently reached, in order to destroy the larvae and prevent further depredations. The work of this insect was also observed by Dr Lintner on other trees that same year. The young of this second generation were not carried to maturity, and consequently nothing further could be learned regarding its life history in America. This species is stated by an European authority

to feed in August and September on the underside of willow and poplar leaves, the adults appearing in June.

Description. The larvae of this insect have been described by Dr Lintner as follows:

When near maturity, they were $\frac{7}{10}$ of an inch long, of an orange-yellow color, with two rows upon the back (subdorsal) of 12 large irregularly rounded black spots, measuring in diameter about $\frac{1}{2}$ the length of the segment. There is also a row on the side (stigmatal) of 12 smaller black spots, of which the 2 anterior ones are the largest, and semicircular in form. Numerous short white hairs are given out from two transverse rows of tubercles on each segment, the longest of which about equals one half the diameter of the body. The head is black superiorly and laterally, with a central black spot in front surrounded with brown. The tarsal hooks are brown.

Adult. Head, shining black, short, broad, not so wide as the thorax; antennae brown, the seven long joints are slender, tapering regularly to the last. Thorax black above, yellow laterally, and beneath, except posteriorly where it is black. Abdomen yellow, distinctly incised, short, flat, suboyoid; legs yellow. Wings yellowish towards the base and particularly on the costa; the stigma large, conspicuous, with a black spot on its base.

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Pteronus hudsonii Dyar

Black-headed, bluish or leaf-green sawfly larvae with series of orange-yellow, large blotches on segments 3–12 and numerous black spots, sit on the edge of poplar leaves.

The larva has been described by Dr Dyar as follows:

Larva. Sitting on the edge of a leaf and thrashing the abdomen about when disturbed. Head normal, round, black, sutures paler; width 2.2 mm. Thoracic feet moderate, pale, abdominal ones on joints 6–11, 13, well developed; short black anal spines. Body smooth, shining, faintly 3-annulate, dorsal vessel yellowish; color bluish or leaf-green, with a series of orange-yellow, large lateral blotches on joints 3–12 and numerous black spots as follows: two transverse rows per segment above the spiracles, the anterior of three on each side, the posterior of four, its lower (lateral) one largest; two black patches on the halves of the subventral ridge, the lower posterior one somewhat broken; on joint 13 a large lateral black patch and dorsal suranal blackish cloud.

The adult insect is a little over 1/3 inch in length, black with a rusty yellow abdomen.

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Pteronus vertebratus Say

A greenish, solitary edge-feeding sawfly on poplar belongs to this species.

This sawfly larva was taken by Dr Dyar on poplar at Plattsburg N. Y. and its egg and early stages have been described by him as follows:

Egg. Laid in semicircular incisions under the upper epidermis, 1.5 mm long.

Second stage. Head testaceous, a brownish shade up from the black eye; width .65 mm. Body pale yellowish, the food showing green by transparency, slightly shining, subannulate.

Third stage. Head as in the next stage, but pale testaceous; jaws black, width 1 mm. Body the same, slightly shining, subannulate.

Fourth stage. Head greenish, with a slight honey tinge, large, higher than the dorsum; a faint blackish shade runs up not far from the black ocellus which is surrounded by a black spot; mouth brown, a dark mark for antennae; width 1.4 mm. Body subtranslucent, poplar leaf-green, not shining, the segments folded; no annulets or the merest trace. Feet on joints 6–11, 13; anal prongs short, brownish; blackish marks at the base of the clear thoracic feet; tracheal line evident, no tubercles.

Fifth stage. The same with the same width of head.

The adult female is about 1/4 inch in length, light yellow marked with black or darker brown. The male is a little smaller, black, marked with yellow, and with the entire venter of the same color.

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Hylotoma pectoralis Leach

Yellowish, black-spotted, sawfly larvae about 3/4 inch in length, with reddish yellow heads, feed during August and early September on birches.

This insect is rarely brought to the attention of economic entomologists, though several reports of its occurring in immense numbers on

birches in Quebec have been placed on record. The larva may be recognized by its jet-black eyes and yellowish red head, and specially by the six rows of conspicuous black, nearly confluent spots down the back, in connection with a lateral row of elongated ones and the two rows of black spots on the underside of the body at the base of the legs. The dorsal rows of spots are nearly confluent, about three to each segment, except on the last, which is naked and sparsely clothed with rather coarse hairs. This species feeds on white birch in the neighborhood of Quebec during August and September. Dr Fletcher has recorded this insect as very abundant in several Quebec localities in 1887, they being present in myriads in the eastern portion of the province. These false caterpillars spin cocoons on attaining full growth, the adults appearing the following July or early in August and deposit eggs for a subsequent generation. The perfect insect has black antennae and head, with spots on the breast and ovipositor blue black, the remainder of the body, excepting the legs which are steel blue, being yellowish red. This species has a general distribution in the northeastern United States and Canada, and is probably rather abundant some seasons in the Adirondacks. There is no practical method of preventing its depredations, particularly as birch has very little commercial value.

Nematus unicolor Marlatt

A brown-headed, greenish sawfly larva resting alone on its venter on the underside of birch leaves belongs to this species.

This sawfly was met with by Dr Dyar on white birch at Keene Valley N. Y. Its larva has been characterized by him as follows:

Larva. Head slightly granular, shagreened, a little pilose, pale brownish, pale around mouth, not shining; eye on a black spot; two blackish shades on the back of head behind the vertex; width 1.8 mm. Thorax a little enlarged, its feet spreading; venter flattened; feet on joints 6–11 and 13; subventral region slightly fluted with a few pale setae; segments not very completely 5- to 6-annulate, segmental incisures folded; not shining, translucent greenish, food giving a dusky tint; subdorsally below the skin a series of emerald-green or pale green granules and streaks, forming a nearly continuous band, or even an evident white subdorsal band; tracheal line evident; spiracles pale. When mature the larvae became pale

yellowish with a bright emerald green tint on the thorax and entered the ground.

The adult female is nearly $^1/_3$ inch in length, uniformly reddish yellow marked with brown.

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Pteronus latifasciatus Cress.

Brown-headed, purplish, solitary or partly gregarious sawfly larvae occur on white birch.

The larva of this insect was met with by Dr Dyar at Keene Valley and his description is as follows :

Head vinous brown, dotted with brown over the vertex, eye black; width 1.6 mm. Body purplish vinous tinted, a metallic red-green shade over the dorsum, partly produced by the food showing by transparency; segments indistinctly 6-annulate, shining, a lateral black shade band, scarcely noticeable against the metallic shade, supplemented by black patches on the folds around the spiracles, subventrally and on the bases of the legs, the latter distinct against the pale purplish subventral color. Feet all pale, yellowish tinged; abdominal on joints 6–11, 13, small; anal plate and short prongs black; setae minute, seen with a lens.

The adult insect is a dusky black, white-marked, sawfly about $^1/_3$ inch in length.

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Amauronematus luteotergum Nort.

A black-headed, greenish sawfly larva feeding gregariously on the edges of alder leaves belongs to this species.

This larva was met with by Dr Dyar on alder at Keene Valley N. Y. and he has described two stages as follows :

Larva. Head shining black, sutures of mouth pale; width .85 mm. Feet on joints 6–11 and 13; anal prongs black. Body shining green, yellowish subventrally and on the legs; segments obscurely annulate, all minutely pilose, but no distinct tubercles; a blackish subdorsal shade-band

and also blackish on the two parts of the subventral ridge. Thoracic feet and anal plate shaded with dusky black; a medioventral series of black patches.

Last stage. Head shining dark vinous, eye black; minutely pilose; width 1.1 mm. Body shining, sordid greenish, rather dark, shaded more or less with vinous, especially subventrally; segments obscurely annulate, minutely pilose; dorsal vessel a dark band; the subventral ridges show as blackish elevations. Thoracic feet partly, anal plate and prongs largely black.

The female is about $^1/_3$ inch in length, very robust, black, marked with yellowish rust-red.

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Alder flea beetle

Haltica bimarginata Say

Deep prussian blue, rounded flea beetles about $^1/_4$ inch long or dark brown, black-headed, black-tubercled larvae occur in large numbers on alder.

This species is sometimes exceedingly abundant in the Adirondacks, and were it not for the fact that alder is comparatively valueless, its depredations would result in considerable loss, as it is more or less abundant from year to year. The ravages by this beetle have been recorded by Dr Harris and Dr Packard in Maine and New Hampshire, and Dr Lugger states that this species is sometimes exceedingly numerous and destructive to willows growing on the shores of Minnesota lakes.

Description. The pupa and larva have been described by Dr Packard as follows:

Larva. The body is somewhat flattened; head scarcely two thirds as wide as the body in the middle, black, becoming brown in front near the jaws. Body livid brown above; the tubercles black; paler beneath, with three pairs of black jointed thoracic legs; no abdominal legs, but an anal prop leg. The abdominal segments each with a transverse, oval-rounded, ventral, rough space forming a series of creeping tubercles; and in front of each segment is a transverse, oval, crescentic, chitinous area bearing two piliferous tubercles; the back of each segment divided into two ridges, each bearing a row of six sharp tubercles, bearing short hairs; a single

ventral row on each side of the ventral plate. Length 7–10 mm (.28 to .4 inch).

Pupa. Body rather thick white. Antennae passing around the bent knees (femero-tibial joints) of the first and second pairs of legs, the ends scarcely going beyond the middle of the body. Elytra with five or six rather deep, longitudinal creases. The salient points of the body armed with piliferous warts. Abdominal tip square at the end, with a stout, black spine projecting from each side. Length 6 mm (.24 inch).

The parent insect has a uniform, deep prussian blue color with greenish reflections on the head and an elevated line near the outer border of each wing cover. It is a rather stout, rounded flea beetle about 1/5 of an inch long.

Life history. The larvae are abundant skeletonizing alder foliage in July and even as late as August and into September, though beetles begin to predominate in the latter months. Dr Lintner states that the pupae are normally found under moss coating adjacent rocks; hundreds were brought to light lying loosely in the mold and without the slightest indication of cocoon or cell. They were about an inch below the surface and distinctly yellow in color, though Dr Packard has characterized them as white.

Distribution. This species has an extended distribution according to Dr Horn, who states that it occurs in the entire northern portion of the continent, as far south as Pennsylvania, thence westwardly, extending over the western plains to Texas and Arizona, and on the Pacific slope from Alaska to Mexico.

Attelabus rhois Bohe.

Peculiar, thimblelike rolls of leaves on alder, hazel, and sumac, may be the work of this species.

This dull reddish beetle has the body clothed with a short yellowish down, and is about 1/5 inch long. The egg is nearly spheric and about 1/25 inch in diameter.

Life history and habits. The singular, thimblelike rolls of this weevil may be found in June and July on alder and also on hazel and sumac. When about to lay her eggs, the female begins to eat a slit near the base of the leaf, on each side of the midrib and at right angles to it, so that the leaf may be folded together. Before rolling, she gnaws the stem nearly off, so that the rolled portion of the leaf will dry in perhaps a day and drop

with the wind. The ends are neatly tucked into the somewhat tight roll till a compact, cylindric, nearly solid mass of vegetation is formed. Before the entire leaf is rolled, she deposits a single egg, rarely two, in the middle next to the midrib, where it lies loosely in a little cavity. The egg hatches in about a week.

Eight-spotted forester

Alypia octomaculata Fabr.

Reddish, black-ringed caterpillars about 1½ inches long, feed from June into August on Virginia creeper and grapevine.

This rather common insect is occasionally quite injurious to Ampelopsis or Virginia creeper, and it is also a grapevine pest. The caterpillar is easily recognized by the above characters and can be readily controlled by spraying with an arsenical poison wherever this measure is practical. The parent insect is a beautiful black moth with eight lemon yellow spots on its wings, which latter have a spread of 1½ inches.

Rose beetle

Macrodactylus subspinosus Fabr.

This familiar species is a well known pest of roses and needs no description. It is particularly abundant on sandy soils, where it sometimes occurs in immense numbers. Grapevines and rosebushes in particular suffer from its depredations, though it is almost equally injurious to apple, pear, cherry, peach, plum and most other fruit trees as well as some forest trees. A few specimens were taken on hard pine at Karner in June 1901, and it was abundant the following year on scrub oak.

There is probably no better way of protecting valuable plants from the ravages of this voracious insect than by covering them with mosquito netting.

Calligraphus lunata Fabr. was found eating wild rose blossoms at North Chatham June 6, 1902.

Rosebud worm

Olethreutes nimbatana Clem.

Greenish, black-headed caterpillars about $^1/_2$ inch long, boring in the buds or webbing together leaves of roses, may belong to this species.

This insect was brought to the attention of the late Dr Lintner in March 1883, on account of its injuries to rose plants in greenhouses at Scarsdale, Westchester co. It is well distributed over the State and probably more or less common, since it is known as an annual rose feeder in Albany.

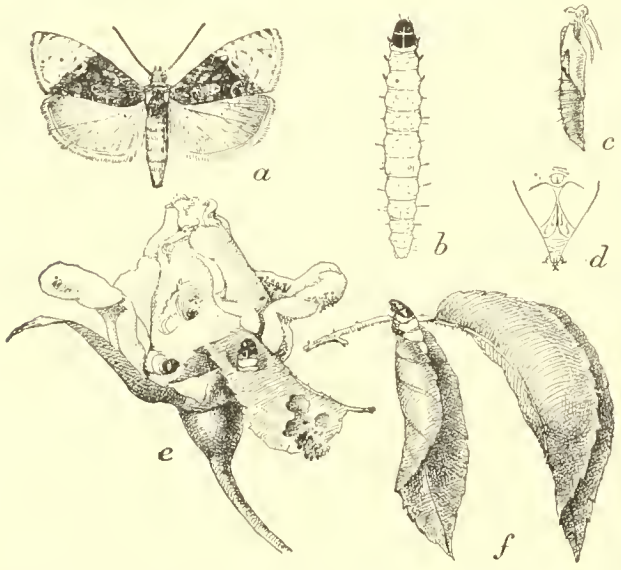


Fig. 144 Olethreutes nimbatana: *a*=moth; *b*=larva; *c*=empty pupal case; *d*=terminal segment of pupa; *e*=rosebud showing larva at work; *f*=leaves folded by larva; all twice natural size except *d*, which is greatly enlarged. (After Chittenden, U. S. Dep't Agric. Div. Ent. 1901, Bul. 27, n. s.)

Description. The full grown caterpillar is about $^5/_8$ inch long, a clear apple-green color, with the head and thoracic shield dark blackish brown and the true legs a dull black.

The parent insect is a brownish gray moth with the outer portion of the fore wings and the under surface of the hind wings lighter. The inner part of the fore wings is dark brown mottled with white, black and light purple spots; wing spread about $^5/_8$ inch.

Life history The life history of this species has been given by Dr Lintner substantially as follows. The parent insects appear about the middle of April and deposit their eggs at night, presumably on the terminal leaves of rosebushes. The caterpillars soon hatch and at once commence to draw together margins and surfaces of the folded leaf, and as they increase in size the single leaf is deserted and several fastened together or, as observed by Mr Chittenden, they may enter the unopened buds. The

caterpillars feed within these shelters, grow rapidly and mature by the last week in May, transforming to pupae among the folded or fastened leaves of the bush. The moths of the second brood were observed by Dr Lintner as early as June 2. Eggs are quickly laid and caterpillars of the second brood are soon at work. The pupal stage is limited to about five days. There are two and possibly three broods in the vicinity of Albany, and Mr Chittenden states that in the District of Columbia there may be three or even four generations annually.

Natural enemies. A single parasite, Eulophus cyriades Walk was bred from this bud worm by Mr Chittenden.

Remedial measures. About the most practical way of controlling this species is to destroy the caterpillars in their web retreats or on open buds, by pinching off and burning or crushing the affected parts.

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Rose leaf tier

Olethreutes cyanana Murtf.

This rose leaf insect occurs as far north as Michigan, south to Missouri and District of Columbia. It has been recorded from Pennsylvania and probably occurs in New York State. This species has been carefully studied by its describer, Miss Murtfeldt.

Description. *Larva.* Length .5 inch, diameter .1, cylindrical, tapering slightly in both directions from middle, but most posteriorly; color dark green, surface glossy with two shallow wrinkles to each segment, spots minute, blisterlike, each giving rise to a fine short hair. A dark vesicular line extends along the dorsum, and on each side below the small dark stigmata is a pale translucent ridge or fold, bearing an irregular row of light hairs more conspicuous here than elsewhere. Head polished, honey-yellow inclining to olive, with a few scattered hairs, palpi white, tipped with crimson. Cervical shield polished, nearly same color as the head, covering top of segment 1. Terminal point of thoracic legs black. Prolegs concolorous with general surface.

Pupa. Enclosed in a pouchlike case formed from a portion of a leaf folded over and lined with silk, elongate oval in form, very pointed poste

riorly and of a bright brown color. Each of the abdominal segments is provided with two transverse rows of teeth, the posterior ridge composed of minute, close-set, rasplike points, while those composing the anterior ridge are longer and more scattered.

In disclosing the moth the chrysalis protrudes itself from its case for nearly its entire length, holding itself in position by the anal hooks.

Imago. Alar expanse from .5 to .55. Length .22. Head and palpi densely tufted, brown with a slight purplish reflection, eyes grayish blue, antennae short. Thorax with a brown dorsal tuft and dark blue patagia. Abdomen fuscous shading to brown above with a silky lustre; front and middle legs fuscous inclining to cinerous, hind legs silvery cinerous, tarsi annulated with pale buff. Front wings dark chocolate-brown and metallic blue; the latter color predominates in the basal third, but is interrupted about midway by an irregular fascia and some scattered flecks of brown; middle portion of the wing mainly brown, but penetrated from both apical and basal sides with streaks and points of blue; on the outer third the blue and brown colors are thoroughly intermixed in a somewhat intricate pattern, the apex being brown variegated with four or five irregular, blue spots, while the inner angle is occupied by a large oblong blue spot divided by an oblique, narrow, brown stripe. The costa presents in a strong light a succession of broad and narrow blue streaks on a purplish brown ground and on the outer edge is a narrow border of the latter color, while the fringe is of a more or less intense blue. Hind wings fuscous, shading to cinerous at base, with a silky lustre, fringe cinerous. Under surface of both front and hind wings fuscous, the former a shade darker than the latter and displaying a faint irridescence. No sexual differences except the smaller size, the relatively narrower abdomen, and conspicuous anal tuft of the male. *Murtfeldt*

Life history. A considerable proportion of rose leaves will be found in early spring, with their tips blackened and tightly webbed together with glistening white silk. An examination may reveal a minute larva eating into the heart of the growing point, not only blackening and distorting the young leaves, but in many instances destroying the incipient flower bud. This species is occasionally so abundant in Missouri that fully 20% of the buds, particularly white or light colored varieties, are destroyed. There are at least three successive broods in a season, the later ones attacking plants in full leaf. The full grown larva deserts the mass of webbed leaves and constructs for its protection a neat case by slitting the blade of a leaf on

both sides a little below the tip and folding and fastening the partially severed portions by the edges to the upper surface. This is lined inside with white silk and in this retreat the insect transforms to a pupa, the moth issuing about 10 days later.

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Cenopis pettitana Rob.

A yellowish green, brown headed, sparsely haired caterpillar a little over ½ inch long, occurs on oak and rose.

This is another rose leaf roller, which may occasionally be injurious and is likely at any time to invade greenhouses and possibly destroy buds. The adult flies, according to Dr Lintner, in early July. The moth has been described by Dr Robinson as follows:

Palpi pale yellow above, ochreous or brownish ochreous beneath. Head and thorax above pale lemon-yellow, sometimes of a deeper shade.

Anterior wings very pale yellow or lemon-yellow, shining. Costa in the male with two aggregations of brownish ochreous scales at basal and apical third.

Posterior wings and fringes pure shining white.

Under surface of both pairs, and abdomen, above and beneath, pure white.

He states that the wing spread of the male is about 78 inch, and that of the female ranges from the same to about 1 1/8 inches. He gives its habitat as western Canada, Ohio, Illinois, and as stated above, it has been recorded from New York. Dr Dyar lists it from the Atlantic States. Dr Robinson states that this is a quite variable species, and an examination of specimens from Illinois resulted in the following description made on the spot: "Head, thorax and palpi above, clear lemon-yellow, the latter brownish ochreous laterally and beneath. Upper surface of primaries in both sexes lemon-yellow; the costa covered with brownish ochreous scales to one third from base. Hind wings above and under surface of both pairs brilliant white." The female is slightly larger than the form described above.

Cenopis reticulatana Clem.

This rose leaf roller is abroad in New York State in July and may be considered a form capable of doing more or less damage from year to year, and should it invade greenhouses is likely to be rather injurious. It has been recorded by Dr Smith from New Jersey localities, where it is stated to feed on rose, geranium, oak, persimmon, pear and maple. Dr Dyar lists it from the Atlantic States. The little moth has been described by Dr Robinson as follows:

Palpi red, very long, proboscidiform. Head and thorax yellow above. Anterior wings yellow finely reticulated with orange. Costa at base tinged with purple. Central fascia purple, commencing in a spot on costa before the middle and ending in the apex of a large triangular spot of the same hue on internal margin. The large purple costal spot throws out a line which is forked just below it, one branch running obliquely inwardly to the triangular spot on internal margin, the other outwardly to before internal angle.

Posterior wings and fringes very pale yellow. Under surface of both pairs pale straw color, the anterior pair slightly reflecting the hue and markings of the upper surface.

The wing expanse has been given by Dr Robinson as from 5/8 to 3/4 inch in the male, and in the female from about 3/4 to 7/8 inch. This species he states varies greatly, the reticulations sometimes being obsolete and the ordinary markings partially so.

Oblique banded leaf roller

Archips rosaceana Harr.

Brown-headed, greenish caterpillars about 3/4 inch long, occur in May and early June in the webbed leaves of a large number of trees.

This species is a very common leaf roller and occasionally destructive to rose and some other more valuable shrubs and trees. It is an exceedingly general feeder, having been bred by Mr Coquillett from some 24 different species of plants, including among others, apple, cherry, lilac, horse-chestnut, burr oak, poplar, hazel and sumac.

The larvae draw together the young leaves at the ends of the limbs,

secreting themselves therein and feed on the foliage. They are slender, pale green or yellowish green caterpillars sometimes reddish or brownish, about $\frac{3}{4}$ inch long, with the head and thoracic shield brown and often a green stripe along the back. They attain their growth in early June, transform to pupae, delicate brown moths with a wing spread of about $\frac{7}{8}$ inch appearing the latter part of June or early in July.

Rose leaf folder

Archips rosana Linn.

A dark olive-green, brown-headed caterpillar feeds within the webbed-together leaves of rose and a number of other plants.

This leaf roller is an introduced species and like its allies, not very particular as to its food plants. It has been recorded from wild rose, apple, hawthorn, raspberry, hazel, currant and gooseberry. Both larva and moth are darker than those of most of our native species. The brownish gray moth, having a wing spread of about $\frac{3}{4}$ inch appears in early June.

Platynota flavedana Clem. This is another small rose leaf roller liable to cause more or less injury outdoors and likely to invade greenhouses, in which latter it may acquire the bud-eating habit.

Walnut curculio

Conotrachelus juglandis Lec.

A curculio very much resembling the plum pest though larger, $\frac{1}{4}$ inch long, frequently infests walnuts and butternuts.

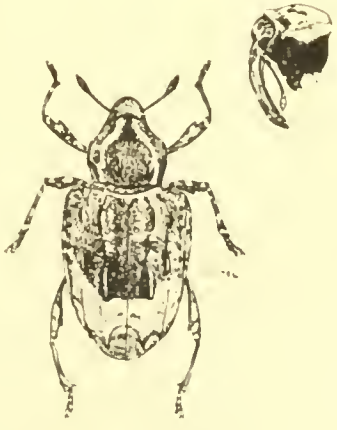


Fig. 145 Conotrachelus juglandis, enlarged (original)

This species very closely resembles the plum curculio. It is about $\frac{1}{4}$ inch in length, reddish brown and prettily ornamented with golden and silvery hairs. The most conspicuous feature is the broad transverse whitish band on the posterior third of the wing covers. The curious projections on the wing covers seen in the plum curculio also occur, and an examination with the lens shows them to be strongly ridged and ornamented with several minor processes.

This curculio is the parent of the worm frequently occurring in walnuts and butternuts, and the presence of the pest is indicated by a discolored spot on the green husk. Dr Lugger states that these insects frequently take the lion's share of our native nuts. Mr Young has met with the insect in early June at Poughkeepsie, and has taken it at Newport N. Y. Mr Ulke records this species on hickory from the District of Columbia, and Dr Packard states that it has been taken from walnuts at Mt Carmel Ill.

This species was described from the Middle States. It occurs in various sections of New Jersey, breeding in green butternuts and walnuts, and has been listed from southwestern Pennsylvania by Dr Hamilton, who states that it is common on walnut and hickory.

Conotrachelus seniculus Lec.

A small, long-snouted obscure brown-colored weevil about $\frac{3}{16}$ inch in length, marked with a yellowish white transverse band on the posterior third of the wing covers, occurs on butternut and hickory.

This small species was taken on hickory May 26 and June 5 at Poughkeepsie by Mr Young. It is a small, inconspicuously colored species which may be recognized by the elytral markings given above. The wing covers are rather strongly ridged. Dr LeConte states that it is of the same form and size as C. nenuphar Herbst., and is distinguished from C. affinis Boh., chiefly by the broader and more strongly carinate prothorax; by the two lines of pubescence being straight and meeting at the front margin, and by the first ventral segment being less punctured than the others.

Dr LeConte records this species from the Middle and Western States and Texas, and Dr Hamilton states that it is not common in southwestern Pennsylvania. It has also been listed from the District of Columbia, from the vicinity of Cincinnati and New Jersey.

Hickory shuck worm

Enarmonia caryana Fitch

A slender, white caterpillar about $\frac{3}{8}$ inch long, mines hickory shucks causing them to abort and fall prematurely.

This little miner of the hickory shucks or husks is very common in New York State and so far as our observations go, its operations have been confined to the husk or shuck enveloping the nut. Dr Shimer states that in Illinois the larvae live in the nut of the bitternut hickory, Carya amara, destroying its interior and causing it to fall. Dr Fitch has placed on record the statement of Louis Potter of Easton N. Y., to the effect that this insect was so numerous in his section in 1856, that several of the hickory trees scarcely produced a single nut. According to Dr Shimer, the moths appear the latter part of November, hibernate in this stage and live till some time in June, when they deposit eggs on the young nuts. Dr Fitch states that specimens of this insect were received by him from Easton N. Y., in April, with a letter saying that the insect pupated about the first of February, the moth emerging the latter part of that month. Dr Packard records taking unrubbed specimens of this moth May 20, in a growth of young hickories at Providence. These two records seem to indicate that some of the insects hibernate in the larval or pupa stage.

Description. The moth has been described as follows, by Dr Fitch:

Sooty black, the fore wings with reflections of tawny yellow, blue and purple; their outer edge black, with oblique triangular whitish streaks placed at equal distances apart. A very oblique faint silvery blue streak extends inward from the points of two of these white streaks, namely, the fourth and sixth ones from the tip of the wing; while the usual white spot on the inner margin of the wings is wanting. Expanse of wings, .6 inch.

Acorn weevil

Balaninus nasicus Say

A weevil, with a remarkably long slender curved beak, occurs on acorns or may be bred from white legless grubs within them or other nuts

This species was met with in small numbers when collecting in June at Karner in 1901, and was bred the following season from acorns on the

bear or chestnut scrub oaks. This species was noticed by Dr Harris who states that it is one of the most common nut weevils known to him, and he adds that it is very common in hazelnuts, chestnuts and acorns. Dr Fitch states that hickory nuts are seldom affected by worms, referring to this species or perhaps also to allied forms, and adds that they are much more frequently met with in hazelnuts, chestnuts and acorns. He failed to rear any of these insects as was also the case with Dr Harris. Dr Packard states that Professor Riley bred this species from a lot of acorns of Quercus grisea, received from Fort Grant Ariz., July 26, 1882, and Messrs Howard and Riley record breeding this species from a lot of acorns from which B. uniformis Lec. was obtained. Dr Packard also published a note of Professor Riley's to the effect that this species breeds entirely on hickory nuts, while Mr Harrington states that in the neighborhood of Ottawa Can., it is never found on hickory but frequents the hazel almost entirely, being very numerous on these bushes in some years.

Description. This species has been described by Dr Harris as follows:

Its form is oval, its ground color dark brown; it is clothed with very short rust-yellow flattened hairs which more or less conceal its original color, and are disposed in spots on its wing covers. The snout is brown and polished, longer than the whole body, as slender as a bristle, of equal thickness from one end to another, and slightly curved; it bears the long elbowed antennae, which are as fine as a hair, just behind the middle. This beetle measures nearly $^3/_{10}$ of an inch in length, exclusive of the snout. [*See* pl. 17, fig. 19, 20]

The larva or grub of this species has been desribed by Dr Riley as yellow, with reddish brown head and dark brown mandibles.

Life history. Dr Harris records finding this species paired on hazelnut bushes in July, at which time the eggs are probably laid. He adds that others appear in September and October, and must pass the winter concealed in some secure place. Mr Glover states that there are said to be two broods, the last one probably hibernating in the earth, and reports Mr Akhurst of Brooklyn as observing that these insects sometimes remain in the larval condition over one season. Mr W H. Patton states that the following species of Balaninus have been reared from acorns: B.

caryae Horn, B. uniformis Lec., B. nasicus Say, B. rectus Say, and B. quercus Horn.

Natural enemies. This species is apparently exempt from the attacks of natural enemies. Messrs Riley and Howard record the rearing of Trichacis rufipes Ashm. MS., from cocoons infested with this insect, and Holcocera glandulella Riley from St Louis Mo., and states that this is probably from a Cecidomyiid inquiline. It thus appears that no undoubted parasitic enemy has yet been obtained.

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Chestnut weevils

Balaninus proboscideus Fabr.; *Balaninus rectus* Say.

Wormy chestnuts are familiar to all lovers of this favorite nut, though the parent insects are not so well known as their unwelcome grubs.

Chestnuts are so seriously infested by this insect in some seasons that a large proportion of the crop is rendered worthless. It not infrequently happens that a lot of chestnuts stored in some box or vessel soon after gathering are found a few weeks later badly infested and sometimes nearly entirely destroyed by the white grubs or young of this weevil. The chestnut is a valuable native nut, and one which is apparently capable of considerable development. There are now many acres in this and other States almost unproductive which might produce large crops of this nut. It is stated that great quantities of Spanish nuts are imported yearly though equally good, if not better ones, can be grown here. Several individuals are now engaged in growing this nut for the market, and as an illustration of what has been done, the 20 acres of bearing paragon trees of Mr H. M. Engle, Marietta Pa., may be mentioned. Native trees were cut on a steep hillside and the sprouts grafted to this improved variety, and in about three years they began to bear. The trees were kept trimmed and the ground clear from underbrush, and it was stated in 1896 that the land

yielded more in value than an equal area of potatoes, and at much less expense. The grafting of an improved variety on native stock renders it easy in a few years to transform worthless trees to valuable fruit producers. The most serious drawbacks are stated to be underbrush, injury by insects and thieves.

Injury by chestnut weevil. The amount of damage this insect causes varies with the season and the locality. The following facts published by Dr Lintner give an idea of the damage caused by the insects:

Mr R. C. Hewson, Penn Yan N. Y. estimates the annual loss of native nuts in that vicinity at from 5 to 10% of the crop. This appears to be rather a conservative estimate, since in Massachusetts as high as 40% of the chestnuts in certain seasons are injured by these weevils. Sometimes in New Jersey 50% of the Japanese and Spanish varieties are ruined, and Dr Smith cites an instance in which the crop was almost entirely destroyed at the Parry Brothers nursery. The loss in Maryland ranges from 10 to 25%, in Delaware from 30 to 40%, and in North Carolina from 10 to 50, possibly averaging about 20%. From 5 to 25% of the few native nuts in Michigan are injured by the weevils.

Species attacking chestnuts. There are at least two species which injure chestnuts in this country.

The large chestnut weevil, Balaninus proboscideus Fabr. may be distinguished from other American species of this genus, as stated by Dr Horn, by the first joint of the antennae being shorter than the second. It is a beautiful variegated insect with fuscous lines and spots interspersed among the dense ocherous scales on the thorax and wing covers. Some examples of this species are entirely ocherous. The beak of the female is very long, and ranges from $1\frac{1}{4}$ to twice the length of the body. The distribution of this species has been given by Dr Lintner as follows: Massachusetts, New Jersey, Pennsylvania, District of Columbia, North Carolina, West Virginia, Ohio, Illinois, Tennessee, Middle States westward. Other localities are recorded by McCarthy for chestnut weevils, but the species are not indicated.

The smaller chestnut weevil, Balaninus rectus Say, has a wider recorded distribution, as follows: Canada, Massachusetts, New York, New

Jersey, Pennsylvania, District of Columbia, Virginia, West Virginia, Ohio, Southern States and Arizona. Besides the above, chestnut weevils have been reported from Delaware, Maryland, Georgia, Michigan, and Missouri, but without having been referred to either species. Possibly each of the species may have a distribution over the United States coextensive with its chosen food.

The smaller chestnut weevil, Balaninus rectus Say ranges from about $^1/_6$ to $^1/_3$ inch in length, the general color of the scales or hair is light brown above, pale yellow below, and on the thorax there is a dark brown discal stripe, which is limited at the sides, and divided longitudinally by a pale yellow line. The wing covers are variously marked with the same color. The beak of the female is very long, being equal to or even longer in proportion than in the larger species. The long beak and the long conical thorax is said to distinguish B. rectus from the other members of the genus. The male is not so readily recognized. "It has a shorter thorax, but it is still narrowed anteriorly; this, with small femoral tooth oval elytra rapidly narrowed from base, and a yellowish or brownish spot of condensed scales on each side of the central line of the metasternum (occasionally obsolete), will, with practice, distinguish it." *Hamilton*

Life history. The life history of these two species agrees very closely so far as known. The weevils appear about the time the chestnuts bloom and oviposit in the young burrs. The long snout of the female is well adapted for piercing the kernel, and one or more eggs are then deposited therein. The slight injury to the husk and nut soon heals, and there is no exterior indication of the insect's presence. The holes observed in wormy chestnuts are made by the larvae when forsaking the nut. The females are said to live but a short time, a week or two at the most. All the larvae of this species enter the ground in the autumn, none winter in the nut, though this has been thought probable by some writers. Dr Hamilton states that the appearance of the smaller chestnut weevil in breeding cages was much more irregular than that of the larger, varying from June 28 to Oct. 1. On this latter date he found in the cage pupae in various stages, and many

larvae or grubs that would doubtless live through the winter. A delay till the second season appears to be quite common in this species, and is one of nature's safeguards against extermination should there be an entire failure of the crop in any one year, as happens occasionally. This smaller species is known to breed in chinquapin nuts and acorns, as well as chestnuts while the larger form has been obtained only from the latter. There is apparently no record of the larger species remaining in the pupa stage till the second year, although it is probable that such occurs. Only one parasite, Urosigalphus armatus Ashm. has been bred from this chestnut weevil.

Remedial measures. There is no practical method of preventing oviposition, unless it be by jarring which would probably prove too expensive in most cases. The infested nuts should be destroyed each year before the insects forsake them and enter the ground. Wormy chestnuts may be easily recognized by pouring the nuts into a vessel of water, and the lighter ones will rise to the surface after a little stirring. The sound ones should be dried, and it would be safer to thoroughly treat them with carbon bisulfid, using at least one pound for each 1000 cubic feet of space and exposing the nuts to the fumes for about 24 hours.

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FREQUENTERS, USUALLY INJURIOUS, OF DECIDUOUS FOREST TREES

Ring-legged tree bug

Brochymena annulata Fabr.

This dark grayish black, rather thick tree bug about 5/8 inch long, may be taken from midsummer to the end of the season and probably in early spring, on various trees.

There are only three examples in our collection and these were captured from miscellaneous trees; one, in particular, probably occurring near or on pines.

Description. This species has been frequently mentioned in literature, though in some instances it has probably been confused with B. 4-pus-

tulata Fabr. Mr E. P. VanDuzee of Buffalo, who kindly determined our specimens, states that this species may be recognized by the short, broad head, truncate at the apex, with the apical sinus nearly transverse. The surface is finely and coarsely punctured and ornamented in places by groups of large, black punctures; the sides of the pronotum before the sinus are strongly arcuated and armed with close regular teeth; the second joint of the antennae is much shorter than the third, and the rostrum is longer, usually reaching the third ventral segment. He states that this is a comparatively rare species, which he has seen only from the eastern United States, his material showing a range from southern New York to Florida. Messrs Walsh and Riley record the insect from Hannibal Mo. in 1869, at which time it was considered beneficial. Its distribution has been given by Uhler as Colorado, Texas and a large part of the United States east of the Mississippi river. Mr C. H. T. Townsend lists it from Kansas, and Professor Osborn states that it is common in Iowa. Dr Smith also lists this insect from a number of New Jersey locations and from Staten Island.



Fig. 146 Brochymena [illegible] enlarged (origin [illegible])

Habits. There are several records of this species occurring on appletrees in considerable numbers, and Messrs Riley and Howard cite a case in Virginia, where this insect attacked a new growth of appletrees in the month of May. It is there known as the "large chinch bug," and many twigs and limbs were said to have been killed by the insect. These gentlemen add that the adults occur under bark in midwinter, and that the eggs and young larvae have been found on pea vines and willow.

Professor Webster also records a case where this insect killed the shoots on some young appletrees in May 1894, at Owensville O. This was on the farm of Mr Lowell Rauderbush, who wrote Professor Webster that he had carefully watched the insect in the summer and found that it also

attacked young plumtrees. Professor Webster observed this species in large numbers on larches near Cincinnati, and on various fruit trees in Ohio northward to Lake Erie, and he records in addition, taking the insect in Illinois and Indiana. Professor Pettit notes its occurrence in Michigan, though no record of injury is given.

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Brochymena quadri-pustulata Fabr.

This is a rather stout, dark gray plant bug about 5/8 inch long. It was taken by us on hard pine at Karner and on willow at Nassau, and occurs rather commonly from July to the end of the season and in March, April and May on various trees and shrubs in different sections of the state. We have specimens kindly determined by Mr E. P. VanDuzee of Buffalo from the following New York localities: Warwick, Nassau, East Greenbush, Karner, Ilion, Newport, Ithaca, North Hector, Pike, Batavia and Hamburg. Mr VanDuzee has seen this form in several collections under the name of B. annulata Fabr. The distinguishing characteristics as given by him are the "long head, narrow and cleft at the apex, the rounded anterior margin of the humeri, and the pale, irregular teeth on the sides of the pronotum anteriorly." It is probable that some of the records given under B. annulata Fabr., refer to this insect. This is probably the species we have met with in abundance on appletrees, four or five being observed within a short distance of each other, and we have also taken it on plumtrees, though no instance has come to our knowledge of serious injury. This species is noticed but rarely in literature, though Uhler has recorded it from Texas, New Mexico and Louisiana, and Dr Smith lists it from several New Jersey localities, adding that it occurs late in the fall, early in the spring and occasionally in winter and that it is not injurious.

Brochymena arborea Say

This is a stout, grayish, rosy or red-marked tree bug about 5/8 inch in length. It is remarkable for the serrate and angular projections of the pronotum and the large toothlike processes of the head. We have taken this species at both Nassau and Lansingburg N. Y., in the former locality on or near willows, and in the latter probably about growths of miscellaneous bushes. Mr Townsend gives its distribution as the Atlantic States, while Professor Osborn records it as common in Iowa. Dr Smith lists it from Staten Island and a number of New Jersey localities, stating that it is common about Caldwell.



Fig. 144 Brochymena arborea, enlarged (original)

Buffalo tree hopper

Ceresa bubalus Fabr.

A grass-green, triangular two-horned leaf hopper, about 3/8 inch long, may be met with in the latter part of the summer on a number of trees and shrubs.

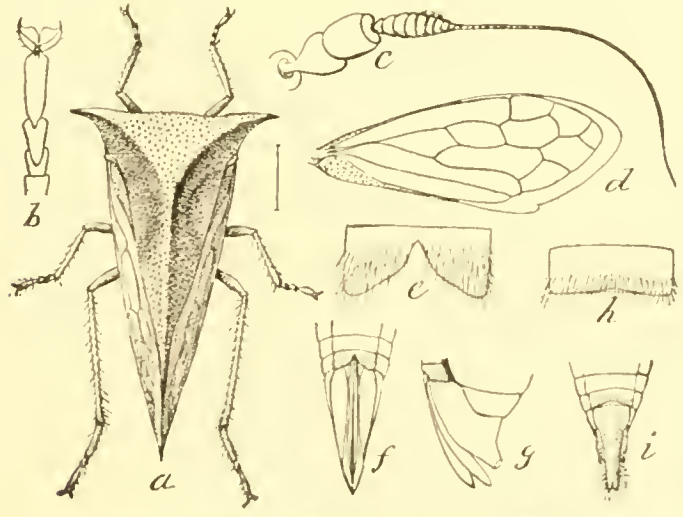


Fig. 145 *a* female; *b* enlargement of foot; *c*—antenna; *d*—wing; *e*, *f*, *g*—terminal segment and ovipositor of female; *h*, *i*—terminal segment of male abdomen. (After Marlatt, U. S. Dep't Agric. Div. Ent. 1897, Cir. 23, 2d s.)

This grotesque little insect is a very common species sometimes present in considerable numbers. It rarely inflicts much injury on forest trees and is important from an economic aspect largely on account of the damage done to young fruit trees.

Description. The egg is about 1/16 inch long, slightly curved, tapering toward the outer end and more rounded at the other. It is a dirty whitish

color, without markings, and cylindric, except as its shape is modified by pressure of the wood and adjacent eggs. The young resemble the adults but are wingless and armed along the dorsal line with numerous forked or barbed projections. The adult is a green insect, about 3/8 inch in length, and may be easily recognized by the greatly enlarged thorax which bears on its anterior angles lateral projecting horns, as represented in figure 148.

Life history. The life history of this insect has been given by Mr Marlatt substantially as follows:

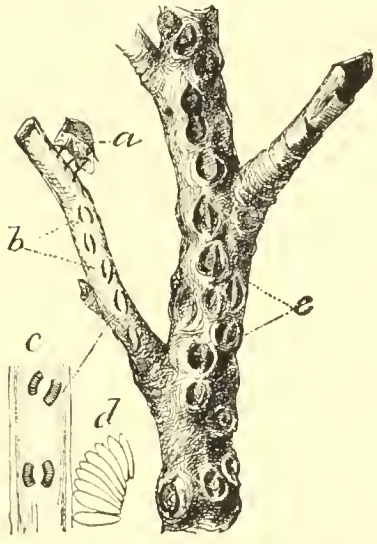


Fig. 149 Twig of apple showing: *a* female at work, *b* recent egg punctures; *c* bark reversed with eggs in position, slightly enlarged; *d* single row of eggs still more enlarged; *e* wounds of two or three years' standing on older limbs. (After Marlatt, U. S. Dep't Agric. Div. Ent. 1897 Cir. 23, 2d s.)

The adult insect deposits her eggs in twigs of various trees, preferably those of two or three years' growth, particularly the apple, willow, cottonwood, maple etc. and confines its operations in general to the upper surface of the twigs. It works more abundantly on the south side of the trees than on the north, though in this respect the prevailing winds and other conditions appear to have an influence. The eggs are deposited quite as readily in the new growth of old trees as in young growth though the damage is much more noticeable in the latter. They are placed in small compound groups of from six to 12 eggs, each arranged in two nearly parallel or slightly curved slits extending in the direction of the twig about 3/16 inch, and separated by 1/8 inch or less of bark. The bark is cut by the ovipositor in such a way when depositing the eggs that the narrow portion intervening between the two incisions is loose. This has a very important bearing on the subsequent condition of the wounds made by the insect in oviposition. The object is doubtless to cause a deadening of the wood between the two rows of eggs, and thus prevent their being crushed or choked by the subsequent rapid growth of the twig, and it is due to this peculiarity that the injury later assumes such a serious nature. A single

incision made by the insect would heal over and cause little after-damage, but the combination of the two incisions and the killing of the intervening bark causes it to adhere to the wood and a large scar is produced, which with subsequent years' growth assumes an oval form, the dead bark of the center breaking out. Limbs which have been thickly worked by the insect become very scabby and rough, are easily broken off by the wind, and are very liable to attack by wood-boring insects. The adults appear about the middle of July and become most numerous during August and September. They begin oviposition about the middle of the former month, or even earlier, and continue till they are killed by the frost of early winter, sometimes working as late as the end of October. The number of eggs deposited by a single female exceeds 100, and possibly 200. The eggs remain unchanged or dormant in the twigs till the following spring, hatching in May or early in June.

Food plants. The young as well as the adults feed on all sorts of succulent vegetation, such as weeds and garden vegetables, and are apparently not particularly fond of the apple, much preferring the more succulent annual plants. Mr J. G. Jack states that he has found the adults feeding on the young tender shoots of the apple near the ground, though Dr Marlatt states that after careful and repeated observations in an orchard, so badly infested as to be nearly ruined, he failed to find any indication of the insects feeding on the apple, and he concludes that the infestation that Mr Jack observed must relate to the suckers springing from the base of the tree.

Distribution. This insect has evidently a very general distribution in the United States, since it has been recorded from Canada, southward to Missouri, at least, and westward to the Rocky mountains.

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Two-marked tree hopper

Enchenopa binotata Say

A peculiar, brownish, black tree hopper with an enormous hornlike projection over its head, occurs in the fall on a number of plants.

This little insect is very peculiar on account of the enormously developed prothorax, which makes it appear as though it were the bearer of a large horn. It is very probable that this structure is of advantage, since the resting insect bears a very close resemblance to a thorn and on this account is no doubt overlooked by natural enemies. This tree hopper is specially fond of bittersweet, which it occasionally injures seriously. It occurs on this plant during July and August in company with its young, a group somewhat resembling a flock of old and young partridges in miniature. The egg covering of this insect is as unique as the parent. It is a snow-white, frothy mass about 3/16 inch long by 1/8 inch broad, and an examination with a lens shows that it is composed of a double row of numerous small, stringy, transverse masses laid side by side, those of each row meeting end to end along a somewhat irregular median ridge. See plate 17, figure 15, for an illustration of the adult and plate 49, figure 4, for a representation of the peculiar egg coverings.

Description. The full grown insect has been described by Dr Harris as nearly 3/10 inch long, including tne horn of the thorax; of a dusky brown color, and with two yellow spots on the ridge of the back. When seen sideways it presents a profile much like that of a bird, the head and neck of which are represented by the curved projecting horn of the thorax. The young of this little tree hopper, of various sizes, clustered together on a stem of the waxwork, may be likened to a flock of old and young partridges. They appear to pass through all their transformations on the plant, are fond of society, and sit close together with their heads all in the same direction. The eggs, as stated by Dr Lintner, are arranged in much the same way as those of the cicada, inserted through a single hole, in two parallel series separated by a small interval. There are in each row from six to 12 eggs, which partly overlap one another. They are elongated.

almost cylindric, of a delicate green color, pointed at the more deeply buried end, and rounded and of a yellowish tint at the opposite extremity.

Life history. The life history of this insect is incompletely known. The young were found by Dr Riley on the 10th of May at which time after passing their first and third molts, on May 18 and June 5, they transformed to perfect insects June 12. The young are described as being without the hornlike projection of the thorax, and they appear to lack the ability to hop which the adults possess, and from which they derive the common name of treehoppers. The time of oviposition is not known, but it is probably not prior to the middle of August in New York State, for on the 8th of that month Dr Lintner observed the mature insects abundantly on locust, when none of the egg coverings were observed. A correspondent of Dr Lintner's records finding the egg covering in the early part of September. We have found them in October and the insect undoubtedly winters in the egg.

Food plants. This species occurs on a number of plants during the latter part of the summer. It may be found on grape, red hoptree and trefoil, the latter its favorite home. It has been recorded as occurring on the leaves of the butternut and locust, and has been observed on wisteria.

Distribution. This insect has an extensive range, having been recorded by various writers from Canada, Massachusetts, New York, New Jersey, Pennsylvania, Maryland, Illinois, Michigan, Iowa, Missouri and Texas.

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Thelia acuminata Fabr.



Fig. 130 Thelia acuminata, enlarged (original)

This, one of the most grotesquely shaped of our tree hoppers, is characterized by the enormous development of the prothoracic horn, which extends nearly vertically with a uniform diameter to a rounded tip $\frac{1}{8}$ inch above the large prothorax. The insect is about $\frac{1}{4}$ inch in length, yellowish, densely mottled with brown or dark brown, specially

on the prothoracic horn [pl. 17, fig. 17]. A single specimen was taken on scrub oak at Karner July 24, 1901, and Mr E. P. Van Duzee, who kindly identified the species, states that it is a rather rare form, being met with only occasionally in his own collecting, and seldom represented in lots sent for identification. It has been recorded by various writers from Pennsylvania, Arkansas, New Jersey, Massachusetts, Michigan and New York.

Thelia godingi Van Duz.

This is one of our more grotesquely shaped leaf hoppers. It may be recognized by the enormously developed prothorax which forms a stout, nearly vertical, rounded horn. The median line on the posterior portion of the horn and on the top of the immensely developed prothorax is marked by a lenticular whitish line. The remainder of the prothorax is yellowish brown marked with darker brown, specially near the extremity of the horn, where it is nearly black. The head is yellowish and the eyes are black. This pretty leaf hopper was taken in small numbers on scrub oak at Karner, July 27, 1901.



Fig. 151. Thelia godingi, enlarged (original)

Telamona monticola Fabr.

This grotesque little leaf hopper measures about 3/8 inch in length and may be distinguished by its yellowish brown color and the broadly rounded elevation of the immensely developed prothorax. It is a very common species on the Virginia creeper or ampelopsis, and was taken by the writer in small numbers on scrub oak at Karner in July 1901. Dr Fitch in his catalogue of the Homoptera of the State of New York, published in 1851, described this form as T. querci and states that it occurs on scrub oak.

This insect has been recorded from Massachusetts, New York, New Jersey, Maryland, North Carolina and Illinois by various entomologists and presumably has a general distribution in the Eastern States at least.

Archasia galeata Fabr.

An apple-green, somewhat triangular tree hopper with an enormously developed prothorax, occurs on scrub-oaks and other trees from midsummer to early fall.

This species has the prothorax remarkably developed into an arched shield covering most of the body [pl. 17, fig. 16]. It is triangular in outline, whether viewed from the front or above, and the membraneous wings extending from under the pronotum, are greenish, brownish or yellowish brown in color. This species is about 3/8 inch in length, and was met with in small numbers on scrub-oaks at Karner in 1901, specimens being taken the latter part of June, during July and toward the latter part of September. This species is occasionally very abundant and infests hickories as well as oak.

Cyrtolobus fenestratus Fitch

This is a prettily marked tree hopper measuring only about 3/16 inch in length. It is triangular in form when viewed from almost any aspect, and has somewhat the shape of a very small beechnut. The prothoracic shield is irregularly banded with light, brownish yellow, light brown, dark brown and white, and the banded effect is greatly increased by the brown wing tips. The eyes vary in color from a yellowish white to dark brown. Three specimens of this insect were taken on scrub oak at Karner June 26, 1901. It has been recorded from as far west as Colorado, as ranging north into Canada and as occurring in several southeastern states. It is doubtless a widely distributed form.



Fig. 152 Cyrtolobus fenestratus, enlarged (original)

Jassus olitorius Say was taken on scrub oak at Karner Aug. 20, 1902.

Pediopsis basilis V. D. was abundant at Karner June 2, 1903, on poplars.

Idiocerus suturalis Fitch was taken at Karner the latter part of June 1903 in considerable numbers on poplar.

Agallia quadripunctata Prov. was abundant at Poughkeepsie May 21, 1903, on honey locust.

Clastoptera proteus Fitch. Larvae and adults of this species were abundant on Cornus at Kenwood N. Y. July 11.

Lightning leaf hopper

Ormenis pruinosa Say

This active little leaf hopper is a trifle over $\frac{1}{4}$ inch in length and may be recognized by its whitish covering over the dark purplish or brownish wings. The young insects are a delicate green and bear long flocculent masses of woolly matter. Both young and adults are very active and occasionally occur in immense numbers. A single example was taken on scrub oak at Karner July 19, 1901. It has been met with by the writer in large numbers about ornamental bushes in a dooryard, and Mr Young found it present in enormous numbers on a catalpa tree, which did not seem to be injured in the slightest.

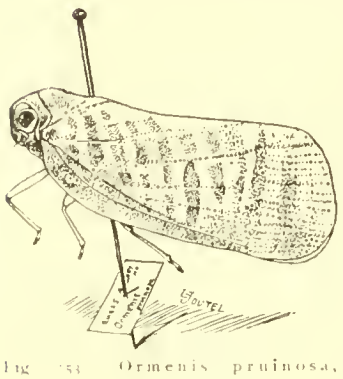


Fig. 53 Ormenis pruinosa, enlarged (original)

Hawthorn tingis

Corythuca arcuata Say

A small net-veined insect, about $\frac{1}{8}$ inch in length, may be found on the underside of Crataegus or thorn and oak leaves during the summer.

This species or one of its varieties is quite common in New York State on oak leaves and an assemblage of its peculiar egg masses is an interesting sight. It is occasionally abundant enough so that toward the end of the summer foliage of oaks and other plants infested become somewhat dry and withered.

Description. The insect in its various stages has been described by Professor Comstock as follows:

The eggs of this insect, which, I think, have not been described, are smooth, whitish, glistening, semitransparent and ovoid in shape. Their

average length is .01 inch. They are deposited on their broad end, and seem to be somewhat inserted into the substance of the leaf; they are covered completely by a brown, sticky substance, which hardens soon after oviposition. It adheres so firmly to the egg, specially to the upper portion, that it is impossible to remove it without crushing the egg. At its upper end this covering of the egg is squarely truncate, giving the whole mass the appearance of a frustum of a cone with a porous lid. From the funnel-shaped summit the young insect makes its exit, and the round hole at this point renders the empty eggs readily distinguishable from those still unhatched. The eggs are usually laid, in groups of from 10 to 30, along both sides of some prominent leaf vein. They bear a much greater resemblance to certain forms of fungi, notably the genus Phoma, and to certain young homopterous galls, than they do to eggs of any sort.



Fig. 154 Corythuca arcuata, eggs and young (After Comstock)

The immature insect is of the same dirty brown color as the substance covering the egg, and but little darker than the withering leaf. It is of a broad, flat, oval shape, and spines seem to project from almost every portion of its body. It looks under the microscope more like a lobe of a prickly cactus than anything else we can think of. The cast-off skins stick to the leaf, and give it the appearance of being much more seriously infested than it really is.



Fig. 155 Corythuca arcuata, adult (After Comstock)

The general appearance of a mature individual is well shown in figure 155. It is about 1/8 inch long.

Professor Comstock states that the species ordinarily hibernates in the adult condition, and may be found during the winter under the loose bark of a tree or under sticks or stones on the ground.

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Ciliated tingis

Corythuca ciliata Say

Very delicate reticulate winged insects, about 1/8 inch in length, may be found on the foliage of buttonwood.

This species was brought to the attention of Dr Lintner about 1888, and was noticed briefly in his report. It was received by him from Prof.

D. S. Martin who took this species in its young and adult condition on the leaves of buttonwood or sycamore. The adult has been described by Say as follows:

Whitish, reticulate with nervures on which are short spines; widely margined; color whitish; thorax with an inflated carina before, extending over the head; sides dilated, bullate, a little elevated, lateral and anterior margins ciliate with short spines; scutel with the lateral margin elevated and an acute, highly elevated carina on the middle; hemelytra dilated, with an inflated carina before the middle of each, on which is a brown spot; edge ciliate with short spines, excepting the posterior third and tip, which are unarmed, rectilinear; beneath piceous-black; feet pale yellowish.

Length to tip of hemelytra, $^{3}/_{20}$ of an inch.

The larva is spinous, fuscous, with a large yellowish spot each side of the middle, and before the middle a broad yellowish vitta. The species is very common.

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Woolly maple leaf aphid

Pemphigus acerifolii Riley

Blackish or purplish, winged, woolly plant lice occur in large numbers on the underside of curled, soft maple leaves.

This species is rarely abundant enough to excite attention, though occasionally it is quite injurious, specially in the Southern States. Professor Johnson has recorded instances of serious injuries to soft maples for several years in succession, and in June 1905, this species was excessively abundant on soft maples at several points in the Hudson valley. It may be easily recognized by the large amount of woolly matter, it being sometimes nearly as long as the insect. This form may be separated from the closely allied Pemphigus aceris Monell., which lives on the underside of hard maple limbs, by the antennae reaching only to the wing insertion, whereas in this last named the fourth joint extends to the base of the wings. This species is sometimes excessively abundant on the underside of soft maple foliage in June and the leaves may be badly curled as a result. The insects usually desert the trees early in July and as a rule remedial measures are unnecessary.

Birch aphid

Callipterus betulaecolens Mon.

A delicate yellowish plant louse is sometimes exceedingly abundant in midsummer on the underside of birch foliage.

This little species is sometimes very injurious to birches in the vicinity of Albany, particularly the ornamental cut-leaved variety, and it is occasionally quite destructive in other portions of the State, complaints of its depredations having been received from Herkimer county and also in the vicinity of Buffalo. There is no method of keeping it in check aside from spraying with contact insecticides such as a whale oil soap solution or kerosene emulsion and ordinarily that is impractical. The pest, when abundant, is fed on to a considerable extent by adults and larvae of the two-spotted lady beetle, Adalia bipunctata Linn.

Woolly beech leaf aphis

Phyllaphis fagi Linn.

Cottony masses occurring on the underside of purple beech leaves usually shelter groups of this plant louse.

This species is a common one on purple beech in parks, and sometimes becomes so abundant as to cover a large proportion of the under surface of the leaves and at such times it may cause considerable injury to the tree.

Description and habits. This aphid is shown clustered on the underside of leaves and along the mid ribs and smaller veins on plate 11, figures 10, 11. The adult females may be recognized by the conspicuous cottony tufts largely concealing the body. The young are pale greenish yellow and may frequently be seen nestling among the hairs so abundant along the leaf veins. The cast skins or exuviae are snow-white, sometimes abundant and may then give a whitish appearance to the underside of the foliage. The partly grown plant louse has the habit of resting with its head close to a vein, from which it is apparently drawing nourishment. The extremity of the young is usually ornamented by a few scattering bluish, white fibers,

The latter become more abundant as the insect develops and eventually nearly conceal it.

Remedial measures. The flocculent woolly secretion serves to protect this species in a large measure, from applications of such contact insecticides as kerosene emulsion or whale oil soap solution, and in order to obtain satisfactory results the spraying must be done very thoroughly and preferably with considerable force.

White flower cricket

Oecanthus niveus DeGeer

This delicate, pale greenish or white insect is one of our common species from the middle of August till the latter part of September, when it occurs on various plants, shrubs and trees.

This flower cricket is about $\frac{3}{4}$ inch in length and may be recognized by its pale color and the usually two nearly circular, black spots on the basal two segments of the antennae.



Fig. 150 Oecanthus niveus, underside of basal antennal segments (After Beutenmuller, Am. Mus. Nat. Hist. Bul. 94)

This species, as well as its allies, is more or less nocturnal in habit, and though found on various plants during the daytime, it is usually comparatively motionless, becoming more active on the approach of night. It is at this time, according to Miss Murtfeldt, that its predaceous habits may be observed. She states that as the twilight deepens, the young crickets awaken to greater activity, and that with the aid of a light they may be seen "hurrying, with a furtive, darting movement over the leaves and stems, the head bent down, the antennae stretched forward, and every sense apparently on the alert." A plant louse is seized and rapidly devoured. She observed that unless a very liberal number of aphids were supplied, none would be found in the jar the next morning.

It is interesting in this connection to refer to the observation of an Indiana nurseryman, who is reported by Professor Webster, substantially as follows: This gentleman experienced much trouble from plant lice till after he planted raspberries in his young orchard, after which his troubles

from these pests ceased to a considerable extent, though the raspberry plants were frequently seriously injured from oviposition by tree crickets.

Professor Piper states that these crickets, after attaining full growth, feed to some extent on the tender shoots of various shrubs and sometimes do a little damage in this manner. The principal injury, however, is caused by the deposition of the eggs in the smaller limbs of various bushes and trees, where they remain over winter and hatch in June. This injury is particularly marked in the case of raspberry and similar soft-stemmed plants. These insects also deposit their eggs as stated by various writers, in peach, apple, grape, cherry, oak, elm, hazel, sumac and willow, and the observations of Dr Hopkins, now of the United States Bureau of Entomology, convince him that considerable injury may follow this act. The wounds made by the tree crickets afford ready entrance for fungous diseases or an opportunity for such plant lice as the woolly aphis to attack the tree and serious deformities may result. Tree crickets, as well as some other insects, suffer to some extent from egg parasites. Two species, Caenus oecanthi Riley MS. and Baryconus oecanthi Riley MS., have been reared from eggs of this species, and the former also from those of O. latipennis. Generally speaking, these tree crickets are beneficial, and as a rule they should not be destroyed, though occasionally some injury may be caused.

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FREQUENTERS, USUALLY BENEFICIAL, OF DECIDUOUS FOREST TREES

Cicada killer

Sphecius speciosus Drury

This handsome black, yellow-marked wasp, with rust-brown wings, about an inch in length, is a southern form and ordinarily occurs from Poughkeepsie southward, being more abundant in New Jersey and places having a similar climate, than farther north. This fierce, striking wasp was rather common at Karner, only a few miles west of Albany, in the summer of 1901, at which time it was observed about scrub oaks, evidently

attracted to the exudation from the starting buds, though in no instance was it detected trying to capture insects.



Fig. 157 Cicada killer (author's illustration)

This species received its common name because of its habit of preying on the cicada, which is stung into insensibility, then dragged to the foot of the burrow, an egg deposited and the excavation filled. In due time the grub appears, feeds on its prey and develops into a wasp. This insect has been so abundant at Poughkeepsie as to occasion complaints because its numerous large burrows rendered lawns unsightly.

Fifteen-spotted lady beetle

Anatis ocellata Linn.

This large rather common species was met with on hard pine at Karner in 1901, where it probably preyed on plant lice and other small forms infesting the trees. This species was observed on several occasions about other trees infested by plant lice, particularly pines where Chermes pinicorticis Fitch was abundant and also in the vicinity of Norway maples infested by Chaitophorus aceris Linn.

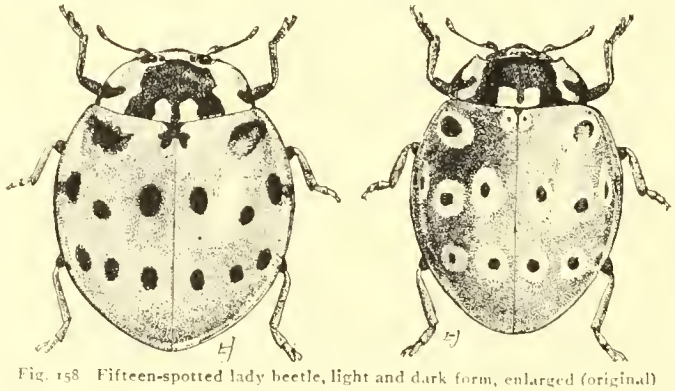


Fig. 158 Fifteen-spotted lady beetle, light and dark form, enlarged (original)

Neomysia pullata Say



Fig. 151. Neomysia [illegible] enlarged [illegible]

This, one of our medium sized to large lady beetles, was taken in small numbers on hard pine at Karner in 1901. One specimen was captured June 4 and another July 8. The species may be recognized by its head being nearly black, or with very few light markings on it and more specially by the nearly uniform yellowish red or yellowish brown wing covers.

Hyperaspis binotata Say

A minute, black, red-spotted lady beetle less than 1/8 inch in length, was met with on scrub oak at Karner, May 14, 1902. It was bred in some numbers October 3, 1902 from a branch of scrub oak badly infested with a species of Lecanium found at North Chatham N. Y. July 6. It probably preys on such soft-bodied insects as it can overcome as well as on scale insects. The species appears to be rare in this State. It has been recorded by Casey from New Hampshire, Pennsylvania, Maryland, Indiana, Wisconsin, and Dr Smith lists it from New Jersey, where it occurs on pine trees in spring and on willows in summer. It probably appears in Dr Hamilton's list of southwestern Pennsylvania, Dury's list of Cincinnati species, and in Ulke's list of forms occurring in the District of Columbia, under the name of H. signata Oliv.

Limonius quercinus Say. This beetle was beaten in June from scrub oak at Karner.

Hydnocera verticalis Say

A slender, yellow-headed, blackish and yellowish beetle occurs in early spring on low shrubs and trees.

This species was reared from a larva found in an oak gall at Normanskill near Albany, May 10, 1902.

Description. Length about 1/8 inch; head yellowish; eyes black; thorax longer than wide, cylindric, black; wing covers shorter than the abdomen, not meeting at the suture and narrowed to the rounded tip; densely punctured and with a large yellowish spot extending from the base nearly to the middle; legs yellowish.

Habits. This predaceous insect is undoubtedly beneficial and has a wide distribution in the northeastern United States, having been recorded from the vicinity of Buffalo N. Y., southwestern Pennsylvania, various localities in New Jersey and from the District of Columbia.

Hydnocera subaenea Spin. This species was beaten in June from both pine and scrub oak at Karner.

Paratenetus punctatus Sol.

A small, brownish black beetle about 1/8 inch long, occurs among dead leaves and also in nests of tent caterpillars.

This small beetle is rather stout, with a dark brown coarsely punctured head and thorax, coarsely granulated eyes, the thorax with its lateral margins irregularly serrate. The wing covers have rather large, almost confluent punctures and are ornamented with a somewhat coarse pubescence. This species was met with in early June 1902 at Kenwood N. Y., where it was present in considerable numbers in nests of the appletree tent caterpillar, Malacosoma americana Fabr. It presumably was feeding on the frass and cast skins in the nests, particularly as it has been recorded by Dr Hamilton, as abundant on dead leaves on bushes. Dr Horn records it from the Middle and Eastern States. It has been listed by Ulke, from the District of Columbia, who also states that it is very common on dried leaves. Dury records it from Ohio, Smith from several New Jersey localities and Staten Island, and it has been listed by Zesch and Reinecke, from the vicinity of Buffalo.



Fig. 160 Paratenetus punctatus, enlarged (original)

Soldier bugs: Podisus and Euschistus

Podisus placidus Uhl.



Fig. 161. Podisus placidus, enlarged (original)

This species ranges in length from 3/8 to nearly 1/2 inch and was present in small numbers on hard pine at Karner in 1901, three specimens being taken June 13 and two July 9. It has the angles of the prothorax slightly developed, is yellowish in color, thickly mottled with reddish or reddish brown and with the anterior and posterior angles of the abdominal segments marked with small black spots.

Mr Kirkland states that in the nearly full grown young the head, thorax and wing pads are an intense pitch black, the abdomen dark red, margined with a series of black spots, one on each segment, and with four black spots in a longitudinal row on the dorsum.

This insect is an exceedingly valuable check on several injurious species. The writer in May 1902 found five of these bugs within one tent of the common appletree tent caterpillar (Malacosoma americana Fabr.), and six or seven were observed on the outside of another. Several bugs were seen with their beaks inserted in caterpillars, and in two or three instances a caterpillar hung from the beak of its voracious enemy. Another was observed in association with sawfly larvae (Lophyrus) on hard pine and was probably preying on them, since it did not hesitate to do so in confinement. Young of this plant bug were also taken at Karner in July 1902 feeding on the eggs of the senatorial oak caterpillar, Anisota senatoria Abb. & Sm. In addition to the above, Mr Kirkland states that this species has been recorded as destroying currant worms, Pteronus ribesii Scop., spiny elm caterpillars, Euvanessa antiopa Linn., fall webworms, Hyphantria textor Harr., caterpillars of the white marked tussock moth, Hemerocampa leucostigma Abb. & Sm., H. definita Pack., and gipsy moth caterpillars, Porthetria dispar Linn.

He also states that over-wintering adults appear in early spring, and after feeding about a fortnight on caterpillars occurring at this time,

deposit their eggs on the underside of leaves or on twigs, 50 to 60 being laid by a single female. They hatch in about 10 days and the red and black young feed on the leaves for about a week and then begin to prey on insects, becoming full grown during July. He states that there are undoubtedly two annual broods in Massachusetts, the young of the second maturing in September, and that possibly three generations may appear in favorable seasons.

This species has been recorded from Colorado by Messrs Gillette and Baker, from southern Michigan by Professor Townsend, from Iowa by Professor Osborn, from Canada by Mr Saunders, and Dr Smith states that it is common in New Jersey. The latter is true of both Massachusetts and New York.

Spined soldier bug

Podisus maculiventris Say

This insect is yellowish, with its upper surface so thickly spotted with reddish or dark brown as to give it a general dull brown color. It is about ½ inch in length and is remarkable for the prolonged acute projections of the pronotum.

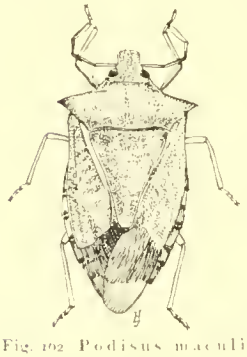


Fig. 102 Podisus maculiventris, enlarged (original)

This species is well known in economic literature under the above common name, while its scientific name has almost universally been given as P. spinosus Dallas. It is the form frequently met with on various plants and is an enemy of the elm leaf beetle. Immature specimens and eggs of this insect were taken at Karner, Sep. 30, 1902 by Mr Young who observed the former preying on zebra caterpillars, Mamestra picta Harris, and he succeeded in bringing the insects to maturity on these caterpillars. This bug is a very general feeder, having been recorded by various authors as preying on such diverse forms as walking sticks, Diapheromera femorata Say, asparagus beetles, Crioceris asparagi Linn., Colorado potato beetles, Doryphora decemlineata Say,

cabbage butterfly, Pieris rapae Linn., fall webworm, Hyphantria textor Harr., white marked tussock moth, Hemerocampa leucostigma Abb. & Sm., a climbing cutworm, Carneades scandens Riley, cotton worm, Alabama argillacea Hbn., a webworm, Archips fervidana Clem., codling moth, Carpocapsa pomonella Linn., Gymonychus appendiculatus Hartig, the morning glory leaf cutter, Loxostege obliteralis Walk., and a sawfly, Selandria barda Say. It is subject to attack by egg parasites, two species, Telenomus podisi Ashm. and Trissolcus podisi Ashm., having been reared from its eggs, which have been described by Dr Riley as "bronze-colored caldron-shaped objects, with a convex lid, around which radiate 15 or 16 white spines." They are placed side by side in small clusters on leaves or other objects. The young bugs, according to Riley, are ovoid, shiny black, with some bright crimson about the abdomen, and when full grown four yellow spots appear on the thorax and the abdomen is more yellowish. This author also states that the diet of the young is principally vegetarian, though a young bug has been observed to destroy a grub of the Colorado potato beetle four or five times its own size. This species has been taken by Mr Bueno, in June, July, September and October, in various localities about New York city, and has been recorded by Dr Smith, from Staten Island. Its distribution has been given by Kirkland, in addition to the above localities, as follows: Canada, Massachusetts, Pennsylvania, Maryland, Virginia, Wisconsin, Illinois, Nebraska, Kansas, Iowa, Missouri Colorado, Indian Territory, Texas and California. He states that it is said to occur generally throughout the south and west, and that it is rare in Massachusetts. Professor Osborn records this species from Williams Ariz.

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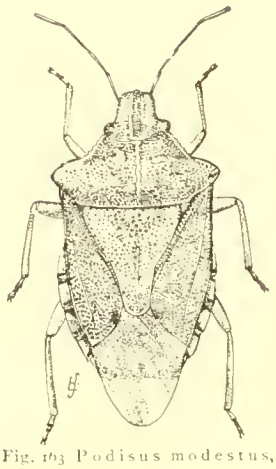


Fig. 163 Podisus modestus, enlarged (original)

Podisus modestus Dallas

This predaceous plant bug measures about 3/8 inch in length, is a yellowish color, thickly mottled with reddish brown, the wing covers being bordered anteriorly by the same color and the tips of the prothoracic angles margined by the same. A single specimen was taken at Karner on hard pine Sep. 6, 1901.

This species has been recorded by Mr Uhler from Dakota, Nebraska, Illinois, Canada and the eastern United States as far south as Georgia. Dr J. B. Smith states that it is not rare in New Jersey.

Euschistus fissilis Uhler

This rather large, yellowish green, brown-mottled species measures about 5/8 inch long, and was taken by us in May and June, on hard pine and scrub oak at Karner. It must be somewhat common at times, since four were taken in one day, and it probably preys, like its relatives, somewhat indiscriminately on caterpillars and other soft-bodied insects occurring on these trees. This species is probably common in New York State, as it has been listed from Staten Island by Smith, and been taken by Mr Bueno, from various localities in the vicinity of New York, during May, June, July and August. It has also been recorded by Uhler, from Colorado, Nebraska, Illinois and parts of the Atlantic States. Professor Osborn states that it is common in Iowa, and lists it from Tacoma, Wash. Messrs Gillette and Baker record it from several Colorado localities, where it evidently occurs throughout the season, having been taken at Fort Collins from April 23 to Oct. 24, and Dr Smith lists it from several places in New Jersey. Prof. F. M. Webster observed this species extracting the milk from immature kernels of wheat in Indiana, and adds that it must inflict considerable damage to both fall and spring grain.

Euschistus variolarius Beauv.

This is a rather stout, reddish or yellowish gray plant bug about ½ inch long, with the humeral angles somewhat prominent. It was found by us quite common on white pines at Round Lake N. Y., Sep. 22, 1902, at which time it appeared to be deeply interested in the web nests of an undetermined tortricid on the larvae of which it probably feeds to a considerable extent. We have taken this insect at Karner during the months of May, early June, September and October, and Mr Bueno records its occurrence about New York city during June, July, August and September. It has been listed from Staten Island by Dr Smith. It is very probable that this species, like some of its congeners, feeds in its early stages on plants to some extent and becomes predaceous and therefore beneficial after attaining some size. It is interesting in this connection to note that Mr F. F. Crevecouer of Onaga Kan., states that the fluid exuded by this species caused a very painful sensation on a sore spot on his finger, being almost like that of a burn. The active character of this fluid has been observed by others, and Mr Young states that in the case of the common Cosmopepla carnifex Fabr., its exudation burns the tender portion of the lip much as described above.



Fig. 164 Euschistus variolarius, enlarged (original)

This species, according to Uhler, occurs in Colorado, Texas and generally throughout the eastern United States. It has been recorded by Osborn from Albuquerque N. M., and Colorado, by Townsend from southern Michigan, by Gillette and Baker as present in a number of localities in Colorado and from the vicinity of Woods Holl Mass. by T. H. Montgomery jr.

This species evidently occurs on various plants, which are injured to some extent. It has been recorded about raspberry bushes (the fruit of which it injures seriously) in gardens by Townsend, and on melon stalks from July to September. Professor Webster reports it as puncturing the

skin of ripening tomatoes, numbers being clustered on the fruit and juice oozing from the wounds, and states that the bugs also attack peaches in a similar manner. Professor Garman has observed serious injury following the presence of this insect on young tobacco plants, causing the sudden wilting of the leaves, and Mr Crevecoeur, mentioned above states, that it often feeds on strawberries.

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Euschistus tristigmus Say

This dark brownish plant bug is about 3/8 inch in length and was met with by the writer in small numbers on hard pine at Karner, one specimen being taken Sep. 18, 1901. This species has been described by Uhler as from Texas, Indian Territory, Kansas, Missouri, and as ranging from Florida to New York. He states that the form with blunt, lateral angles has been taken at Washington, Kansas, Canada, Pennsylvania, Maryland, Iowa and New York, and adds that it sometimes occurs in large numbers during late summer on bushes in damp situations. The species has been listed by Mr Townsend from southern Michigan and Dr Smith records it from a number of New Jersey localities, where it is stated to be locally common.

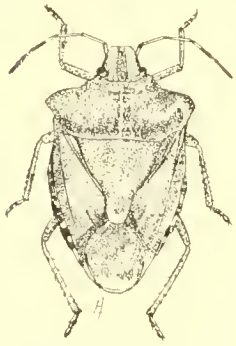


Fig. 165 Euschistus tristigmus, enlarged (original)

Euschistus politus Uhler

This is one of the smaller members of this genus, being only about 3/8 inch in length. It is yellowish and so thickly spotted with dark brown as to give it a yellowish brown appearance. The posterior portion of the wing covers are nearly black. Its head is short and the pronotal angles less developed than in other species. A single specimen was taken by us at Karner, Sep. 30, 1902. It probably occurs on hard pines to some extent. Mr Kirkland states that this rare insect has occasionally been taken under circumstances which gave the impression that it is predatory in habit. The

eggs have been described by him as pearly white, 1 mm long and .8 mm wide, nearly cylindric in form, with both extremities flattened. The cap is surrounded by a row of black, elongated, club-shaped spines, and the surface of the egg is covered with small blunt spines between which are numerous smaller ones. He has found the insect preying on gipsy moth caterpillars, though he is inclined to believe that it more frequently feeds on plants than insects.

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Alydus eurinus Say

This black species, with red-banded abdomen is about ½ inch in length, and on account of its slender form and peculiar movements, resembles an ant to some extent. It was observed in small numbers on scrub oak at Karner, one specimen being taken June 21, 1901 and another in early July 1902. This insect has a wide distribution, having been recorded from as far west as Colorado, south to Texas, as occurring in the Eastern States and ranging north into Canada.



Fig. 166 Alydus eurinus enlarged (original)

Acholla multispinosa DeG.

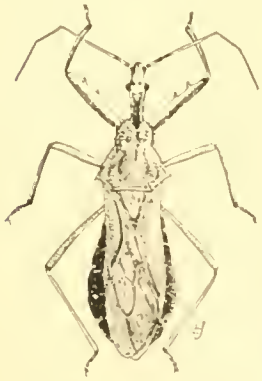


Fig. 167 Acholla multispinosa, enlarged (original)

This predaceous, spiny hemipteron is one of our rather common though rarely abundant forms. It is about ½ inch long, slender in shape, and varies in color from light to dark brown, and it may be recognized by the prominent spines on the top of the head. The young are similar in appearance to the adults, though usually with the abdominal segments colored more or less deeply with red.

Adults of this species were taken in 1901 on hard pine at Karner Aug. 9 and 21, and Sep. 6. Immature specimens of what probably belong to this species were also taken earlier

in the season, three less than half grown being captured July 8, nine about half grown July 19 and two nearly full grown July 27. This species is predaceous and is therefore beneficial. It has a wide distribution, having been recorded from as far west as Nebraska and from a number of the Eastern and Middle States.

Camptobrochis grandis Uhl.

This species was somewhat common on hard pine at Karner during June and July 1901, though on account of its timidity and rapid movements comparatively few specimens were taken. The adult insect is about $\frac{1}{4}$ inch long, oval in outline and inconspicuously marked with brown and yellowish brown. This species has been recorded by Dr Howard as sucking the eggs of the imported elm leaf beetle, Galerucella luteola Müll., and it is very probably a predaceous form living on some of the weaker insects infesting the plants on which it occurs.

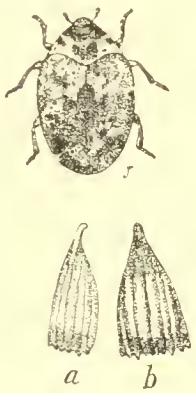


Fig. 168 Anthrenus castaneae, enlarged; *a*, *b*, scales much enlarged (original)

Mr E. P. VanDuzee lists this species from the Muskoka lake district and states that it is apparently nocturnal in habit, since several were captured while flying around a candle at camp. Some of these individuals, he states, are extremely dark, even approaching an almost uniform piceous black. It has been listed from Iowa by Professor Osborn, from Colorado by Messrs Gillette and Baker, and probably has an extended distribution in America.

Anthrenus castaneae Melsh.

An oval, black, golden specked beetle about $\frac{3}{32}$ inch in length, occurs on blossoms of alder and cornus.

This species was taken at Poughkeepsie on cornus blossoms June 3, 1903, and has also been met with on alder blossoms at Newport by Mr Young. The insect is remarkable because of the triangular shaped, crinkled scales covering its body, by which it may easily be distinguished from A. museorum Linn., with which it has probably been confused.

PLANT GALLS AND GALL MAKERS

The abnormal growths frequently found on plants and known as insect galls, excite considerable interest and have led to much speculation as to their origin and manner of development. The species producing these peculiar structures do not compose a natural group, but are found in six orders and two classes of the animal kingdom. Certain of the insects present most remarkable features in their life histories and all have attained the position sought by many of a higher race, in that they secure both food and shelter with little or no labor.

Development of galls. Galls produced by insects or by the somewhat closely allied mites, may be found on practically every portion of the plant. The roots are affected by a number of species of plant lice and mites; trunks or stems are attacked by certain 4-winged gall flies, beetles or Coleoptera, 2-winged gall flies and plant lice, while branches, foliage and fruit or seeds are infested by various species producing most remarkable and diverse growths. These abnormal structures may vary from the comparatively simple galls of certain plant lice, which consist of little more than a folded leaf to the nearly solid, hard cynipid galls on stems. The many celled bud galls may be contrasted with the beautiful fuzzy swellings adorning the stems or leaves of oaks and various plants. These structures, as previously stated, are caused by several insects belonging to widely separated groups, and it is probable that no general law can account for their production. Certain galls like those of the Tenthredinidae or sawflies, are probably produced by the irritation incident to oviposition or the presence of the egg, since, according to several observers, the gall develops before the young hatches from the egg. The larvae of the 4-winged gall flies or Cynipidae, are probably responsible in most cases for the development of the abnormal growths caused by this family, as their activity results in abnormal stimulation followed by excessive cell formation and the development of a mass of unhealthy tissue. The plant lice illustrate another and in certain ways a more remarkable method of development, in that the tissues of the affected plant grow around and inclose the insect. The plant

louse establishes herself on a stem or leaf, drawing nourishment therefrom, and the affected tissues shrink away to some extent, while those adjacent bend over her and eventually form an almost complete inclosure.

Alternation of generations. Certain gall insects are remarkable on this account. The Cynipids had long been a puzzle to entomologists, and the classic studies of Dr Hermann Adler explained many enigmas. Dr Adler's investigations were largely with the oak gall flies, and proved that a remarkable alternation of generations occurs in this group. He found that insects, previously assigned to separate genera, were only members of different generations, and in general his conclusions may be stated as follows: that the parthenogenetic bud-inhabiting gall flies are parents of a sexual generation which oviposits on foliage, producing leaf galls, these in turn producing the preceding form. Previous to Dr Adler's investigations, these parthenogenetic forms had been supposed to be asexual, and according to him certain European species are thus restricted.

The Cynipidae have always attracted more interest, probably because of their higher organization and more perfect galls, yet in complex alternation of generations they are far surpassed by certain plant lice which produce six or seven generations with marked variations in structure and radical changes of food plant, as detailed in the accounts of Hormaphis hamamelidis Fitch and Hamamelistes spinosus Shim., to which the reader is referred for details. It would not be at all surprising if there were other species of gall-inhabiting plant lice presenting almost as great diversities in their life histories.

Gall makers. These, as previously stated, belong to very diverse groups and the gall-making habit has undoubtedly arisen independently in each instance.

The Hymenoptera include some of the best known gall makers, notably the Cynipidae and certain Tenthredinidae. The former are small, dark colored insects with few veins in their four nearly transparent wings. Their galls are always completely closed and though very diverse in character are easily recognized by exclusion, as a rule. They contain, when

inhabited, footless, comparatively helpless maggots. The Tenthredinid gall flies are small creatures with many veins in their four wings. Their galls are likewise closed, and when inhabited are easily recognized by the many footed, somewhat cylindric larvae within.

Coleopterous larvae produce swellings in trunk and limb, which have been classed as galls, and these are in most cases due solely to the mechanical irritation caused by the larvae.

The Diptera or 2-winged flies, include several distinct groups of gall flies. Certain Trypetidae produce solid, closed galls, the one on goldenrod or Solidago being an excellent example. The Cecidomyidae or gall gnats, are the most important gall makers of the family, and deformities may be produced by them in stem, branch, leaf or fruit.. Their galls are usually closed and when inhabited can easily be recognized by the character of the larva, which has the somewhat unique power of propelling itself some distance by bringing the two extremities together and then suddenly extending them. Some gall flies also belong to the Mycetophilidae, but the habit is abnormal for this group.

The Hemiptera include a number of important gall insects, some of which are quite destructive. The Psyllidae or jumping plant lice, include a few gall insects belonging to the genus Pachypsylla, while the majority of galls referable to this group are the work of plant lice or aphids whose characteristics are well known. The deformities caused by these insects, may be easily recognized by the mouth of the gall being open, and when fresh by the peculiar inhabitants.

The Acarina or gall mites, produce many deformities in vegetation, particularly on leaves. These creatures are usually pyriform in shape and remarkable among mites because of their possessing but four legs. Their galls are always open and are frequently ornamented with hair growths. They are sometimes very abundant on foliage and occasionally somewhat injurious.

Gall insects display a marked preference for certain trees, various oaks, the willows and rose-bushes suffering specially from their attacks. Fortunately this group is comparatively harmless to vegetation.

Key for the separation of insect galls

Affecting oak

Galls on twigs

Delicate white, pinkish, woolly growths on twigs

Wool sower, Andricus seminator, p. 622

Woolly oak gall, Andricus operator, p. 622

Rough, gnarled, scaly swellings on red oak limbs

Gouty oak gall, Andricus punctatus, p. 623

Irregularly rounded gall with numerous hornlike protuberances

Horned oak gall, Andricus cornigerus, p. 624

A green or brown, club-shaped gall on tips of white oak twigs

Oak tip gall, Andricus clavula, p. 624

A rough, globular gall with conelike apex

Rough bullet gall, Holcaspis duricoria, p. 624

Bulletlike galls in clusters on white oak twigs

Oak bullet gall, Holcaspis globulus, p. 624

Large uneven galls somewhat resembling a potato in shape, on white oak twigs

Oak potato gall, Neuroterus batatus, p. 624

An irregularly rounded gall on swamp white oak

Noxious oak gall, Neuroterus noxiosus, p. 624

An oval gall composed of wedge-shaped lobes on swamp white oak

Lobed oak gall, Cynips strobilana, p. 625

Irregular reddish or greenish galls in clusters on white oak stems

Oak fig gall, Biorhiza forticornis, p. 626

Galls on leaves

A nearly globular, greenish or brown gall

Large oak apple, Amphibolips confluentus, p. 625

Similar to the above but with interior nearly hollow

Larger empty oak apple, Amphibolips inanis, p. 625

Elongate, fusiform galls on leaves and petioles of dwarf and scrub oak

Black scrub oak gall, Amphibolips ilicifoliae, p. 625

Globular, smooth, green galls $\frac{1}{4}$ inch in diameter on red oak

Oak leaf apple, Andricus singularis, p. 625

White or buff-colored woolly masses on veins of white oak leaves

Oak wool gall, Andricus lana, p. 625

Irregular, woody enlargements at base of the leaf

Oak leaf-stalk gall, Andricus petiolicola, p. 625

Small globular galls on scrub and post oak
Oak leaf bullet gall, Dryophanta polita, p. 626
Irregular, reddish or greenish galls in clusters on leaves and stems of white and scrub oaks..... Oak fig gall, Biorhiza forticornis, p. 626
Somewhat rounded, hard, woody, red, reticulate galls
Warty oak leaf gall, Cecidomyia pilulae, p. 627
Rounded, oblong or oval galls with numerous long spines
Oak hedgehog gall, Acraspis erinacei, p. 627
A globular, spiny gall on dwarf chestnut oak
Spiny oak gall, Cynips prinoides, p. 627
Clusters of seedlike bodies on red oak.... Oak leaf seed gall, Cynips decidua, p. 627
Small, brown, buttonlike galls.. Oak button gall, Neuroterus umbilicatus, p. 627
Marginal fold at base of leaf serration
Marginal fold gall, Cecidomyia crabescens, p. 627
Galls on catkins or fruit
Shotlike, white catkin gall..... Oak flower gall, Andricus pulchra, p. 627
A globular gall growing from the side of acorn cups
Oak plum gall, Amphibolips prunus, p. 628

Affecting hickory

Galls on twigs
Green or black irregular galls on leaf stem or twigs
Hickory gall aphid, Phylloxera caryaecaulis, p. 331
Galls on leaves
Smooth, green, onion-shaped galls with pointed tip
Hickory seed gall, Cecidomyia caryaecola, p. 628
Diplosis caryae, p. 628
Subglobular, pubescent, onion-shaped gall
Hickory onion gall, Cecidomyia holotricha, p. 628
Rounded, brownish, downy gall
Hickory peach gall, Cecidomyia persicoides, p. 628
Narrow, cylindric, tubelike galls.. Hickory tube gall, Cecidomyia tubicola, p. 628
Flattened, circular, yellow or whitish galls
Hickory button gall, Phylloxera foveola, p. 629

Affecting maple

Red, yellow-ringed galls in red maple leaves
Ocellate maple leaf gall, Cecidomyia ocellaris, p. 629
Slender, fusiform galls on upper surface of sugar maple leaves
Fusiform maple gall, Eriophyes acericola, p. 630

Small, bladderlike galls on upper surface of soft maple leaves

Bladder maple gall, Eriophyes quadripes, p. 630

Affecting linden

Sub-globular greenish or whitish galls on both sides of leaf

Linden wart gall, Cecidomyia verrucicola, p. 631

Top-shaped galls on upper surface of linden leaves

Linden mite gall, Eriophyes abnormis, p. 631

Affecting ash

Elongated, greenish or reddish brown galls on the leaf midrib

Ash midrib gall, Cecidomyia pellex, p. 632

Lobulate green or brown deformed catkins

Ash flower gall, Eriophyes fraxiniflora, p. 633

Affecting elm

Cockscomblike structures on the upper surface of elm leaves

Cockscomb elm gall, Colopha ulmicola, p. 186

Solitary, spindle-shaped galls on the upper surface of red elm leaves

Red elm leaf gall, Pemphigus ulmifusus, p. 633

Affecting poplar

Irregular, subglobular enlargements of the young twigs

Poplar twig gall, Agromyza aeneiventris, p. 634

Folded, convolute masses of foliage

Vagabond gall, Pemphigus vagabundus, p. 635

Oval, somewhat elongated galls on the leaf petioles of cottonwood

Poplar leaf stem gall, Pemphigus populi-transversus, p. 635

Imperfect, globular galls at base of cottonwood leaves

Basal leaf gall, Pemphigus populicaulis, p. 636

Affecting willows

Galls on shoots

Fusiform apical galls.....Willow club gall, Rhabdophaga rigidae, p. 636

Irregular fusiform enlargements on the young shoots

European willow gall midge, Rhabdophaga salicis, p. 299

Galls on leaves

Smooth, globular or slightly oval galls like a miniature apple, occur on the leaf midrib

Willow apple gall, Pontania pomum, p. 636

Subspheric, pealike, yellowish galls on the underside of willow leaves

Pontania pisum, p. 637

Smooth, flattish, sessile, yellowish green galls on both sides of the leaf
Pontania desmodioides, p. 638
Fleshy, reddish galls in parallel rows on either side of the midrib
Pontania hyalina, p. 638
A conelike deformity on the tips of willow shoots
Willow cone gall, Rhabdophaga strobiloides, p. 639

Affecting witch-hazel

Conical, green or reddish galls on upper surface of the leaves
Witch-hazel cone gall, Hormaphis hamamelidis, p. 639
Many spined, green or reddish bud galls
Spiny witch-hazel gall, Hamamelistes spinosus, p. 643

Affecting birch

Deformed catkins with enlarged, globular seeds
Birch seed gall midge, Oligotrophus betulae, p. 647

Affecting sumac

Pear-shaped, round or reddish galls on the leaves
Sumac tomato gall, Pemphigus rhois, p. 647

Affecting hackberry

Broadly rounded elevations on the under surface of the leaf
Hackberry nipple gall, Pachypsylla celtidis-mamma, p. 647

Affecting rose

A large, smooth, reddish brown root gall.. Rose root gall, Rhodites radicum, p. 647
Fibrous, mosslike masses on rose and blackberry bushes
Rose bedegar, Rhodites rosae, p. 647
Irregular, spheric, mealy galls..... Mealy rose gall, Rhodites ignota, p. 647
Round galls covered with prickly spines.. Spiny bullet gall, Rhodites bicolor, p. 647
Smooth rounded galls on twigs..... Globular rose gall, Rhodites globulus, p. 647
Elongated, hard, woody galls on twigs
Long rose gall, Rhodites dichlocerus, p. 648
An oblong or rounded gall on wild rose twigs
Knotty rose gall, Rhodites verna, p. 648

Affecting evergreens

Stunted pitch pine needles with basal enlargement
Pine needle gall fly, Cecidomyia pini-rigidae, p. 423
Balsam needles with basal enlargement
Balsam gall midge, Cecidomyia balsamicola, p. 685

Wool sower

Andricus seminator Harris

A delicate white, pinkish marked woolly growth, from 1 to 1½ inches in diameter encircles in June the small twigs of white oak.

This abnormal growth is one of the most beautiful things in nature when in its prime. The delicate creamy white color is admirably set off by blotches of bright pinkish red, and the unexpected weight of the woolly mass only adds to our appreciation. This beautiful gall is a common species in New York State, and specimens are frequently sent to the entomologist with inquiry as to its source and character. As the gall ages, the white becomes a light brown and the pink a somewhat dark brown, and examination of its structure shows that it is composed of numerous small seedlike cells with the spaces between filled by a soft hairlike growth. Each of the seedlike bodies contains an insect and from a specimen received in 1898, 235 adults were reared. The flies appear in June or early July. The operation of egg laying has been described by Dr Harris substantially as follows. He states that the female lays a great number of eggs in ringlike clusters around small twigs of white oaks, and that her punctures are followed by the growth of a rough or shaggy reddish gall, sometimes as large as a walnut. Dr Fitch states that the growth from the eggs laid by the midsummer flies forms a harder and more woolly gall, of a coarser texture and duller color, and that it resembles a ball of wool. These remain through the winter, though their attachment to the twig is so slight that birds often tear them off. The gall is illustrated on plate 49, figure 1.

The adult fly has been described by Dr Harris as $\frac{1}{10}$ inch long, almost black or of the color of pitch, highly polished, except on the abdomen, with the mouth parts and legs a cinnamon color. Dr Fitch states that the female may be distinguished by its longer abdomen and its being black.

Woolly oak gall. *Andricus operator* Osten Sacken. This gall closely resembles the beautiful structure produced by the wool sower, Andricus

seminator Harr. It, when fresh and growing, consists of whitish filaments forming a white round body with beautiful pink spots. Within there are a series of seedlike kernels containing larvae. This gall occurs on the young flowering branches of oaks in June.

Gouty oak gall

Andricus punctatus Bass.

Rough, hard, woody, gnarled scaly swellings on red oak limbs and twigs not over 1¼ inches in diameter, occasionally occur in immense numbers.

This interesting gall insect is ordinarily rare in the vicinity of Albany, if we may base an opinion on the absence of earlier records. The writer's attention was called by Dr H. M. Pollock, in April 1902, to a red oak at Loudenville near Albany, which was very badly infested with the galls of this species. It will be seen by reference to plate 48, figure 4, that these unnatural growths are irregular swellings along the smaller limbs, ranging in diameter from less than ½ to 1½ inches, depending on the size of the twig. They are of variable length and frequently several coalesce to form an elongated mass of diseased tissue. The galls illustrated were inclosed in a box and produced over 500 insects, some of which were guest flies and a few were probably parasites. These galls were made the basis of an estimate and it was calculated that the entire tree bore 20,000 and produced over 500,000 insects. The general character of the infestation is well shown on plate 47.

This species was reared Ap. 11 by Mr Bassett, from a young, thrifty red oak growing in the vicinity of Waterbury Ct. Its local habit is confirmed by his finding galls only on the one tree. Professor Walsh also described what is probably this same species, under the specific name of podagrae, and he likewise refers to its local habits. Both gentlemen, as well as ourselves, reared large numbers of the insects without obtaining males. The perfect insect has been described by Bassett as follows:

Female. Head and thorax black, face pubescent, palpi light brown, tips darker; antennae reddish brown at the base, gradually deepening to a dull dark brown, 14 jointed. Thorax finely and beautifully punctate; three

longitudinal grooves, converging towards the scutellum and a short groove on each side of the middle one, reaching halfway from the collar to the scutellum, also a short, shallow groove or depression over the base of the wings. Scutellum with coarse, irregular pits or punctures. Legs reddish brown, coxae and tips of tarsi dark brown or black. Dorsal portion of the abdomen black, ventral, reddish brown, second segment has a few scattered hairs beneath the wings, others (except the first) minutely punctate. Wings hyaline; veins brown, rather slender; areolet small, distinct; radial area not closed. Length .15.

Horned oak gall. *Andricus cornigerus* Osten Sacken. This irregularly rounded gall is woody with numerous hornlike protuberances through which the gall flies escape. It is very hard, of the same color as the branch, is from ½ to 1¼ inches in diameter and contains within many larval cells. It occurs on the branches of pin oak, scrub oak and black-jack oak and is recorded by Beutenmuller as being exceedingly common in the vicinity of New York city.

Oak tip gall. *Andricus clavula* Bass. A green or brown, club-shaped, hard, woody gall with a few leaves growing from its summit, occurs at the tips of white oak twigs. It is recorded by Beutenmuller as very common about New York.

Rough bullet gall. *Holcaspis duricoria* Bass. A globular, rough gall with conelike apex, occurs somewhat commonly on scrub and swamp oak.

This gall resembles the bullet gall but may be distinguished by its much rougher exterior, less globular form, flattened base, and the apex extended into a conelike process. It occurs rather commonly on scrub oak at Karner and it is stated by Beutenmuller to be rare on swamp oak in the vicinity of New York city.

Oak bullet gall. *Holcaspis globulus* Fitch. Bulletlike galls in clusters of two, three or more are common on the terminal twigs of white oak and occur also on the post and chestnut oaks. This gall is yellow or reddish in summer, turning brown with the approach of cold weather, is corky in texture and contains a larva in the small central cell.

Oak potato gall. *Neuroterus batatus* Fitch. Large, hard, uneven galls ¾ inch thick and two or three times as long, somewhat resembling a potato in shape, occur on white oak twigs.

This peculiar deformity to oak twigs is abundant on the branches of young trees in the vicinity of New York city. It is a hard, woody growth with the surface coated with pale bluish bloom and internally it has a dense corky texture with numerous larval cells. It is sometimes quite injurious on account of its deforming young trees.

Noxious oak gall. *Neuroterus noxiosus* Bass. An irregularly rounded, hard, woody gall resembling that of N. batatus Fitch, occurs on the terminal twigs of swamp white oak.

Lobed oak gall. *Cynips strobilana* Osten Sacken. A large, oval body consisting of a number of wedge-shaped parts closely packed together with their pointed extremities attached to the twig, occurs on swamp white oak [pl. 48, fig. 3]. Each of these wedgelike structures is hard, corky, and contains a larva in the central cell. It is not common.

Large oak apple. *Amphibolips confluentus* Harr. This is one of our common oak galls. It is nearly globular in shape, greenish or brown in color dependent on its age, and its interior is filled with a spongy mass in the center of which is a single larval cell. This species is occasionally quite abundant on trees, as may be seen by reference to plate 50, figure 1, though it cannot be considered injurious. Mr. Beutenmuller states that a certain number of these galls produce both males and females in June and others females in October or the following spring. These latter are merely a dimorphic form.

Larger empty oak apple. *Amphibolips inanis* Osten Sacken. A globular gall closely resembling the oak or May apple, A. confluentus Harr., occurs on the leaves of scarlet and red oak. It is much like the preceding in general appearance, though considerably smaller and may be at once recognized by the nearly empty interior, the small larval cell being held in position by numerous radiating filaments.

Black scrub oak gall. *Amphibolips ilicifoliae* Bass. Elongate, fusiform galls tapering at both ends, with the apex more slender and frequently slightly curved, occurs on the leaves and petioles of dwarf and scrub oak. It is about 1½ inches long, half that in diameter, and contains an elongated kernel held in position by radiating fibers. It is green and soft in summer, turning brown and becoming brittle on the approach of winter [pl. 50, fig. 2].

Oak leaf apple. *Andricus singularis* Bass. A globular, smooth, green gall from ¼ to ½ inch in diameter, occurs rather commonly on the leaves of red oak. This gall is first green and succulent, turning brown and becoming brittle later in the season. It contains a central oblong cell held in place by radiating fibers.

Oak wool gall. *Andricus lana* Fitch. The white or buff-colored woolly masses composing this gall, occur on the underside of the principal veins of white oak leaves. Within it is composed of numerous small larval cells closely crowded together and attached by their lower ends to the vein of the leaf. It is recorded by Beutenmuller as common in the vicinity of New York.

Oak leafstalk gall. *Andricus petiolicola* Bass. These irregularly rounded or fusiform, hard, woody enlargements at the base of the leaf contain many cells. The full grown galls are about ¾ inch in diameter, green in summer, brown in winter and common on several oaks.

Oak leaf bullet gall

Dryophanta polita Bass.

A small, globular gall occurs in numbers in August and September on both surfaces of the leaves of scrub and post oak.

This gall ranges from about $\frac{1}{4}$ to $\frac{3}{4}$ inch in diameter, is at first pale green but sunlight changes it to red or reddish brown. It is found on the foliage of young and thrifty shoots, from one to 20 occurring on a leaf. When dry the shell is very thin and brittle and contains a round larval cell held in a central position by radiating branching fibers which extend to the outer shell. The perfect insect becomes matured in October and remains in the gall over winter.

Oak fig gall

Biorhiza forticornis Walsh

Irregular reddish tinted, greenish galls occur in dense clusters along the midrib of the leaves or on the stems of white and scrub oaks in midsummer.

This species is rather common, and was met with at Karner on the dwarf chestnut oak, Quercus prinoides, being quite abundant in limited localities. The galls on the young twigs and leaves are very pretty about the middle of August, being irregular in shape, greenish yellow and tinted with red. Plate 48, figure 1, represents a mass of forming galls and shows the badly infested shoots as well as the foliage. The galls are found along the midrib on both the upper and under surface. The old galls, as they appear on the dead twig are represented at plate 48, figure 2. It will be seen that they constitute a very irregular mass and look not unlike figs closely packed around a central stem. The gall flies emerge from small circular holes. This species was met with by Dr Fitch on thrifty growing white oaks, on which tree he stated it is quite abundant. His description of the formation of the galls is as follows:

The female pierces the bark with her ovipositor, and inserts a number of eggs at a short distance from each other, apparently sinking them into the wood beneath the bark causing a little discoloration and a spongy spot runs inward from the gall to the pith of the limb. These wounds of the bark heal over so that no indication of their presence can be detected with a magnifying glass. A little smooth round swelling or elevation on the bark soon commences above the egg, increases in size, till at length the bark

bursts, and small round granules, the size of a pinhead, protrude from the openings. These grow more and more, resembling miniature clusters of grapes, at which time they begin to press on each other. They are from $^1_4$ to $^1_2$ inch in diameter, and the outer surface is covered with fine short hairs which become rubbed off from the more exposed portions. The larva lies in a small oval cavity at the base of each gall or lobe, and on account of the tough, whitish leathery walls, there is considerable resemblance to a seed.

Dr Fitch states that most of the galls are perforated before winter, indicating that the flies appear before cold weather. He adds that some clusters may be found in winter containing insects, and these latter appear the following June.

Warty oak leaf gall. *Cecidomyia pilulae* Osten Sacken. Somewhat rounded, hard, woody galls occur commonly on the leaves of pin, red, black-jack and scrub oaks. They appear in May and become fully developed in August or September, at which time they are bright red or reddish brown. These galls vary greatly in size and may be recognized by the characteristic reticulate markings [pl. 1, fig. 16].

Oak hedgehog gall. *Acraspis erinacei* Walsh. A rounded, oblong or oval gall covered with numerous rather long spines, is attached to the upper side of the principal veins of white oak leaves. This yellowish or greenish gall with bright red spines is rather common.

Spiny oak gall. *Cynips prinoides* Beut. This globular gall about $^1_2$ inch in diameter, covered with numerous conelike projections, occurs on the upper side of the leaves of dwarf chestnut oak. It is green tinged with red and contains only one cell.

Oak leaf seed gall. *Cynips decidua* Bass. Clusters of seedlike bodies often 30 or 40 together, grow from the underside of the mid vein of leaves of the red oak. The larger cells are smooth, greenish white with the apex enlarged and are about the size of grains of wheat.

Oak button gall. *Neuroterus umbilicatus* Bass. This small, round, brown, buttonlike gall occurs in considerable numbers on the underside of swamp white oak leaves. The galls are about $^1_{10}$ inch in diameter and are rather common.

Marginal fold gall. *Cecidomyia crubescens* O. S. This peculiar pocket-shaped, marginal gall [pl. 1, fig. 18] occurring in the angles of oak leaves, is somewhat abundant in early summer on certain species of oak, though rarely injurious.

Oak flower gall. *Andricus pulchra* Bass. The rounded, shotlike, greenish white, soft, spongy polythalamous galls of this species were taken on catkins of red oak at Poughkeepsie May 20, 1903, adults appearing

May 29. This species, identified by Beutenmuller, is described in American Entomological Society Transactions, 1890, 17:73.

Oak plum gall. *Amphibolips prunus* Walsh. This globular gall about 1 inch in diameter, grows from the side of acorn cups of the black and red oak, maturing in August and September. It is a solid, fleshy growth with a central larval cell. The parent flies appear in April, according to Dr Walsh.

Hickory seed gall. *Cecidomyia caryaccola* Osten Sacken. The pale green, smooth, elongate, onion-shaped galls of this species have the tip prolonged into a point and are frequently found in clusters on the underside of leaves of various kinds of hickories. Osten Sacken states that the galls are somewhat larger than those made by Diplosis caryae Osten Sacken, and that it occurs through the summer either in separate clusters or mixed with other galls, and Beutenmuller records it as common in the vicinity of New York city [pl. 1, fig. 21].

Diplosis caryae O. S. Clusters of the pale greenish pointed galls [pl. 1, fig. 8], of this species are somewhat abundant in midsummer along the midrib and on the under side of hickory leaves.

Hickory onion gall. *Cecidomyia holotricha* Osten Sacken. A subglobular, pubescent, onion-shaped gall occurs on the undersides of leaves of shellbark and other hickories. They sometimes cover the entire under surface of the leaf, producing a deformity and gradual shriveling. The gall is covered with a pubescence, pale when the gall is young and growing, and becomes rose color as it approaches maturity. It is hollow and contains a single larva. This species has been figured by Glover and Beutenmuller states that it is abundant everywhere in the vicinity of New York city [pl. 1, fig. 4].

Hickory peach gall. *Cecidomyia persicoides* O. S. This rounded, brownish, downy gall [pl. 1, fig. 9], is rather common in midsummer on the under surface of hickory leaves.

Hickory tube gall. *Cecidomyia tubicola* Osten Sacken. Narrow, cylindric, tubelike galls occur on the underside of the leaves of different kinds of hickories. They are inserted in a small protuberance, break off very easily, are green when immature, becoming brown and blackish when ripe. They are hollow, and in October contain a whitish larva with the breastbone terminating anteriorly in a single elongated point. These galls generally occur in clusters. This species has been figured by Glover and Beutenmuller records it as very common in the vicinity of New York city [pl. 1, fig. 10].

Hickory button gall

Phylloxera foveola Perg.

Flattened, circular, greenish yellow or whitish galls about ¼ inch in diameter, occur on the under surface of hickory leaves.

These peculiar growths [pl. 1, fig. 19] are very interesting and are probably the work of this species, though we were unable to obtain adults. This species has recently been described by Mr Pergande, who states that it may possibly be P. foveata Shimer, a form which produces galls very similar to this. These structures were rather abundant on hickory leaves at Nassau in August. They have been described by Mr Pergande as follows:

In the largest and perfectly developed galls the upper side is either of a delicate pale red with the dimple darker and its basal circumference yellowish green; or entirely yellowish green with only the dimple of a beautiful pink color. Beneath they are uniformly yellowish green, often with a faint reddish tinge, especially toward the nipple. On the other trees, most densely covered by them, they were less beautiful, with less red and shallower dimples. The walls are very thin and paperlike and readily collapse when old. All galls are perfectly smooth on both sides.

Ocellate maple leaf gall

Cecidomyia ocellaris Osten Sacken

Red maple leaves are frequently thickly spotted with circular ocellate spots about ⅛ inch in diameter, the disk being yellow with the margin and central dot cherry-red.

This peculiar affection of maple foliage is the work of a small gnat, which, judging from the abundance of its work, must be numerous in the vicinity of Albany [pl. 1, fig. 12]. It has been recorded by Professor Comstock as being very common at Ithaca and as occurring at Washington D. C.

The tissue inhabited by the gall is undoubtedly rendered of little value to the plant and therefore the foliage is injured to some extent. Generally speaking, this species is not injurious, and ordinarily its work may be regarded as ornamental in character, since it gives a decidedly variegated appearance to the foliage. There is no unquestioned record of the adult insect having been reared. The full grown larva drops to the ground

the latter part of September and spins a rude cocoon a short distance below the surface, where it undergoes its transformations.

Fusiform maple gall

Eriophyes acericola Garm.

Slender, fusiform galls are sometimes very abundant on the upper surface of the leaves of sugar maple.

This gall is very slender, about $^1/_5$ inch in length and tapers at both extremities. It is occasionally rather abundant on sugar maple leaves in the vicinity of Albany. This species has been studied by Professor Garman, who states that in five examples of this mite the striae were counted and in three of them numbered 30 and in the other two 28 and 29 respectively. The prongs of the featherlike appendage seemed to be three The mite is about .0075 inch. He has recorded this species as being abundant in galls collected in Illinois in June.

Bladder maple gall

Eriophyes quadripes Shimer

The small, bladderlike galls of this species, about $^1/_{10}$ inch in diameter, are sometimes very abundant on the upper surface of soft maple leaves.

This trouble is sometimes exceedingly prevalent in the vicinity of Albany, the galls being so numerous on certain trees as to disfigure a very considerable proportion of the foliage. The galls, according to Professor Garman, appear with the unfolding of the leaves in spring, as slight swellings of the parenchyma, and as the foliage expands they develop into top-shaped galls on its upper surface. The form varies from discoid to more or less spherical, while occasionally two are fused and have a common opening. The gall is at first of the same color as the leaf, changing later to dull purple or green and afterward becoming the light green of the veins and veinlets, and later changes to purplish, drying up and becoming black at the end of the summer. The outer surface is smooth, though the walls are broadly and irregularly impressed. The position of the gall

is usually indicated on the under surface by a deep impression with a tuft of white hairs in the center [pl. 1, fig. 11].

This mite, according to Professor Garman, has from 37 to 42 coarse striae and is about .008 inch in length. The tarsal claw is slightly curved and terminates in an evident knob. The featherlike appendage has four pairs of prongs. It varies in color from pale yellow to light orange. Matured females, young and eggs occur in June.

Linden wart gall

Cecidomyia verrucicola O. S.

This gall [pl. 1, fig. 13] is sometimes exceedingly abundant in midsummer on linden and quite variable in color, being pale greenish or whitish when young and dark brown or almost black later in the season. It shows about equally on both sides of the foliage. The leaf tissues at the edges of the galls weaken as the season advances, allowing the latter to drop to the ground, so that toward the end of the summer badly infested leaves may be fairly riddled with irregular, circular holes from which the galls have disappeared.

Linden mite gall

Eriophyes abnormis Garm.

Top-shaped galls about $^{1}/_{10}$ inch in diameter, are sometimes exceedingly abundant on the upper surface of linden leaves.

This species is more or less common in the vicinity of Albany, and occasionally leaves are very badly affected. The abnormal growth is produced by a small mite which, according to Professor Garman, differs from all Eriophyidae, in that the abdomen, just before the terminal sucker, is noticeably enlarged. He describes the gall as "top-shaped, expanding above and contracting toward the upper surface of the leaves into a neck. It measures .155 of an inch in height and $^{1}/_{10}$ inch in diameter. The walls are deeply infolded, sometimes giving rise to unequal lobes. The outer surface is smooth, green and devoid of hairs. The cavity of the gall is made unsymmetrical by the deeper impressions of the wall. The inside of the latter is slightly roughened by small folds and is clothed with long

aciculate unicellular hairs." He has recorded the species from Wilmington Ill. [*See* pl. 1, fig. 14]

Ash midrib gall

Cecidomyia pellex Osten Sacken.

A peculiar, elongated, greenish or reddish brown gall wrapping itself about the midrib and inclosing whitish, footless larvae, is the work of this species.



Fig. 169 Ash midrib gall, Cecidomyia pellex (original)

This insect is somewhat common in the Hudson river valley, having been observed in the neighborhood of South Durham by Mr O. Q. Flint and found in numbers at Poughkeepsie by Mr Young. It also occurs about Albany, the galls being nearly full grown the latter part of May or early in June.

The development of the gall is interesting. It appears to be formed by the irritation due to one or more larvae on the upper surface of the midrib of the leaflet. The longer, more conspicuous galls are inhabited by a considerable number, while smaller ones may contain only one or two or three larvae. In each instance it will be observed that the tissues on either side of the midrib and including it to some extent, begin to swell enormously, thicken and gradually close over the irritating larva. The fly has not been bred, due to the rapid withering of the gall, in spite of several attempts to obtain the adult. When young, the gall is a pale green and as it ages it becomes tinged with brown. It is thick and the hypertrophied tissue is very succulent [fig. 169]. This species has been recorded by Professor Beutenmuller from Fort Lee N. J., where it occurs in June.

Red elm leaf gall. *Pemphigus ulmifusus* Walsh. The solitary spindle-shaped galls produced by this plant louse on the upper surface of the leaves of the red elm, are about an inch long. This species is rare in New York State. It occurs in small numbers on slippery-elm.

Ash flower gall

Eriophyes fraxiniflora n. sp.

The staminate flowers of white ash are sometimes very curiously deformed by the work of a small gall mite, which appears to attack them about the time they begin to develop, and by the latter part of June peculiar irregular masses of green tissues are found on the flower stem. An examination shows that each mass consists of a series of irregular, fringed, lobulated masses joined one to the other, each group at this time ranging from $^1/_4$ to about $^1/_2$ inch in diameter. Later they become nearly $^3/_4$ inch or more in diameter, eventually drying and remaining on the trees over winter, giving the infested ones a very peculiar appearance. The work of this mite appears to be moderately common in New York State, though it does not seem to have attracted much attention. Specimens of this mite's work have been received from Brooklyn N. Y. where it appears to infest several trees year after year, and we have also observed its

operations in the vicinity of Albany. It probably causes very little or no injury.

Poplar twig gall fly

Agromyza aeneiventris Fallen

This little fly, kindly identified by Professor Coquillett through the courtesy of Dr Howard, produces oval, smooth swellings about ½ inch long on one side of small poplar twigs [pl. 50, fig. 3]. It is rather abundant at Karner, the insects wintering within the galls as larvae, adults appearing in early spring.

Description. The parent insect is a small, black fly, with red eyes, less than ⅛ inch long.

The larva is a greenish yellow maggot about ⅛ inch long with strongly tridentate jet-black mandibles, as shown in figure 170, and with a pair of spiracles borne on knobbed elevations at each extremity of the body.



Fig. 170 Larval mandible of Agromyza aeneiventris, much enlarged (original)

The puparium is oval, less than ⅛ inch long, each segment with an irregular, slightly wavy, transverse series of chitinous points near its anterior margin. Posterior extremity terminated by a pair of stout, blunt, slightly moniliform processes.

Life history. The young larva apparently begins operations in the green bark, causing an irritation which results in the rapid development of abnormal tissues, producing a spongy, oval mass on one side of the twig — probably hypertrophied bast. These galls vary considerably in size, ranging from about ⅜ inch in length to compound masses about an inch long. The smaller galls contain a single larva while the larger ones may be inhabited by several. The gall tissue is very soft, almost cheesy in texture, very different from the ordinary wood fiber. This is true of the majority of the galls found in the spring, which occur on last year's growth. A few are found on growth of the preceding year, and these are remarkable for containing oval, hard masses of woody tissue a little less than ⅛ inch long. The galls, in older tissues, usually contain several maggots. The larvae make rather broad, short galleries about an inch long in a portion

of the diseased tissues. Fresh excavations are bright green, showing that the dentate mandibles are very effective tools. The gall is sometimes inhabited by an undetermined curculionid larva.

This gall insect is preyed on by a parasite, determined through the courtesy of Dr Howard as Urogaster forbesi Ashm. This gall-making fly has been reared by Professor Webster from larvae burrowing in the roots of clover and tunneling the pith of the common garden sunflower, and Mr Pergande has bred it from stems of ambrosia.

Vagabond gall

Pemphigus vagabundus Walsh.

A peculiar folded convolute mass of foliage some two inches in diameter, frequently occurs on the tips of poplar twigs.

This species appears to be rather common in the vicinity of Albany, and the peculiar convolute, greenish galls or the dry brown remains of the same may often be met with on poplar shoots [pl. 51, fig. 1].

This gall is sometimes very abundant on the tips of certain cottonwoods and poplars, and according to Walsh is much more numerous some years than others. The old blackened galls hang on the twigs for several seasons, thus giving them a characteristic appearance, particularly in winter. The winged plant lice make their appearance in September, and the green, shining, hollow gall appears the following summer. The skin of the latter is quite thin and contains a single wingless plant louse, which is the parent of the colony subsequently inhabiting this peculiar shelter. All become winged in September and desert the gall.

Poplar leafstem gall

Pemphigus populi-transversus Riley

Oval, somewhat elongated galls, with transverse openings, develop near the middle of the leaf petioles of cottonwood during the latter part of the summer.

The galls are nearly $\frac{1}{2}$ inch long, about $\frac{3}{8}$ inch in breadth, and of the same color as the leaf petiole. The mouthlike orifice, when the plant lice are mature, gapes, is nearly transverse and may extend two thirds the way

around the gall though occasionally it is smaller. The interior of the inhabited gall is crowded with plant lice, they being sometimes so abundant as to literally stand on their heads in attempting to obtain nourishment from the succulent walls. The mealy white powder, cast shriveled skins and globules of honeydew are also characteristic features of this insect's retreat. This species has been very abundant in the vicinity of Albany in recent years and was the occasion of a brief note by Dr Lintner in 1897. [*See* pl. 11, fig. 15, 16]

Basal leaf gall

Pemphigus populicaulis Fitch

Imperfect, globular galls ¼ to nearly ½ inch in diameter, occur in June at the base of cottonwood leaves.

These little galls at the very base of the leaf are somewhat irregular in size and shape and otherwise closely resemble the preceding species. This insect was described by Dr Fitch in 1858, at which time it was very abundant in Albany and attracted much notice.

Willow club gall

Rhabdophaga rigidae O. S.

Purplish, fusiform galls ¾ to 1 inch in length are common on or near the tips of low willow shoots. This gall is quite abundant at Karner, the large, pale orange larva wintering in a central channel within the gall, the flies appearing the following May.

Willow apple gall

Pontania pomum Walsh.

A smooth, globular, or slightly oval rosy cheeked gall, like a miniature apple, measuring from .3 to .55 inch may be found growing on one side of the midrib of the leaf of Salix cordata.

This species is rather common in certain localities, and on opening the gall a pale greenish white larva with a pale brown head may be found within. The gall has been desribed by Walsh as follows:

The gall S. pomum is found on Salix cordata and very rarely

on S discolor. A smooth, fleshy, sessile, globular, or slightly oval monothalamous gall, like a miniature apple, .3 to .55 inch diameter, growing on one side of the midrib of a leaf, and extending to its edge or beyond it. The principal part of the gall projects from the underside of the leaf; very rarely it is bisected by the leaf. Color greenish yellow, sometimes with a rosy cheek, especially the upper surface and often with little dots. Fully mature July 31. An analogous gall is formed in Europe on various willows by Nematus gallicola Westw.

The transformations to the yellowish red adult occur within the gall in case of specimens reared by Walsh. There was no earth in the jar and some cocoons were spun between the galls.

Pontania pisum Walsh.

Subspherical, pealike, pale yellowish galls growing on the underside of the leaves of Salix discolor are the work of this species.

This gall-making sawfly is a common species in some sections at least, and on breaking open the hollow galls a whitish, 18-footed caterpillar with a slightly dusky head and dusky mouth parts may be found within.

The gall has been described by Walsh as follows:

A subspherical, pealike, hollow, pale yellowish green gall, always growing on the underside of the leaf and almost always from one of the side veins (in one case from the midrib) and attached to the leaf by only a minute portion of its surface; .18 to .28 inch in diameter, and a few, immature, only .08 inch in diameter. Almost invariably there is but one gall to the leaf, but on four leaves there were two, and occasionally two are confluent. Surface in some smooth and even, without pubescence; in others a little shriveled, generally studded in the medium sized ones with four to 12 small, robustly conical nipples, which in the larger ones have burst into a scabrous brown scar. Only in 3 out of 62 was there any rosy cheek, as in S. pomum. The point of attachment is marked on the upper side of the leaf by a brown subhemispherical depression.

The final transformations to the black yellowish marked adult occur in the ground.

Pontania desmodioides Walsh

A smooth, flattish, sessile, yellowish green gall on both sides of the leaf of Salix humilis in all probability belongs to this species.

The galls of this insect were taken by Mr Pergande at Richfield Springs on Sep. 28, 1886, and it is probably a somewhat common species. The gall has been described by Mr Walsh as follows:

The gall is found on S. humilis. It is smooth, flattish, fleshy, sessile, yellowish green, monothalamus, semicircular in general shape like the seed of a Desmodium or the quarter of an orange. It is about equally divided between the two surfaces of the leaf; no rosy cheek. Generally there is but one gall on a leaf; one leaf was seen with three upon it. Length .23 to .5 inches. 131 specimens. Gall mature July 30.

The larvae resemble those of other gall-inhabitating species belonging to this group, and when full grown transform to the adult within their shelters, at least when there is no earth that can be conveniently entered. The parent insect is about $^1/_5$ inch long, dark brown marked with reddish brown, and with the lower part of the abdomen and the legs rust yellow.

Pontania hyalina Norton

Fleshy, reddish galls on Salix fragilis, occurring in two parallel rows one on either side of the midrib, sometimes touching but not originating from the latter, and rarely extending to the edge of the leaf, may be those of this insect.

This species occurs in New York State, the galls having been collected at Richfield Springs by Mr Pergande in February 1886, adults being bred from the same Mar. 3 and Ap. 27. The gall and its arrangement has been described by Marlatt as follows:

Fleshy galls, occurring in two parallel rows, one on either side of the midrib sometimes touching but not originating from the latter, and rarely extending to the edge of the leaf; sometimes as many as 20 on a single leaf; in other cases confined to a row on one side of the leaf, or occasionally occurring singly; shape irregular, elongate ovate, projecting equally on both surfaces of the leaf; length 7 to 10 mm, the abortive ones smaller. Color on upper side more or less brownish red; beneath white with slight purplish tinge. The galls result from the punctures of the females in the very tenderest leaves, the wound closing and becoming invisible.

Willow cone gall

Rhabdophaga strobiloides Walsh

A peculiar conelike deformity on the tips of willow shoots [illegible] to the work of this insect.

These interesting galls are rather common objects about Albany, and the insect presumably has a wide distribution in the United States, though specific records of its occurrence are not abundant.

Description The gall, a tapering, conelike, terminal growth, is obviously a mass of aborted leaves, one overlapping the other much as the scales of a pine cone. This deformity was figured by Glover in 1874, in addition to the description and illustrations given by Walsh, who also figured the adult fly without describing it.

Life history. The parent insects, according to Walsh, appear in April or early May, and the gall commences its growth shortly after and attains full size by the middle of June. In its early stages it is spherical and enveloped in a dense mass of foliage, which gradually falls off toward autumn, and by November the twig on which it occurs, if small, is killed at the tip. At this time the larva is in the heart of the gall inclosed in a delicate membranous cocoon, where it remains till the following spring, when it transforms to the pupa and shortly after the fly escapes.

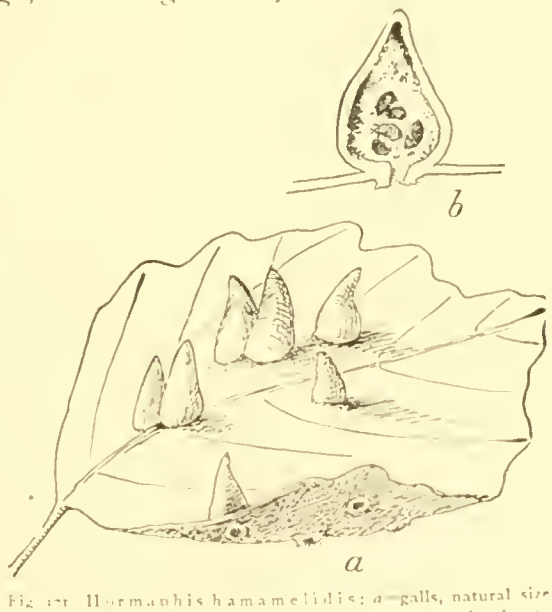


Fig. 151. *Hormaphis hamamelidis*: *a*, galls, natural size; *b*, section of gall, much enlarged. (After Pergande, U. S. Dep't Agric. Div. Ent. Tech. Ser. 3, 1901)

Witch-hazel cone gall

Hormaphis hamamelidis Fitch

Conical, green or reddish galls occur in considerable numbers on the upper surface of witch-hazel leaves.

Though this remarkable plant louse was briefly described by Dr Asa Fitch in 1851, very little was known concerning the species till it was

studied by Mr Theodore Pergande, who had been interested in the insect for over 20 years, and in 1899 succeeded in completing its life history. The following is an abstract of his detailed notice.

The rapidity of growth depends on the season. The galls usually begin to appear in the latitude of Washington D. C., about the middle of April, attaining full growth toward the end of May. Young stem mothers hatch a week or more before the leaves appear and frequently assemble in

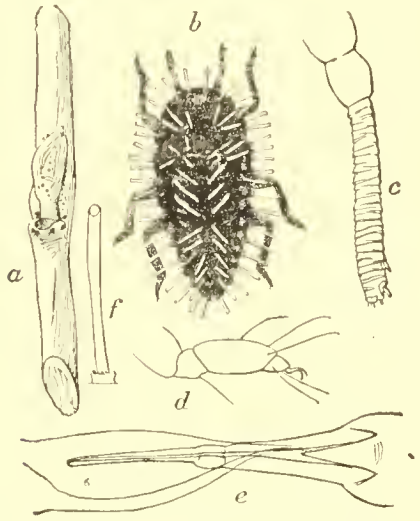


Fig. 172 Hormaphis hamamelidis: *a*—twig and bud with young larva in position; *b*—young stem mother; *c*—antenna; *d*—tarsus; *e*—rostrum; *f*—waxy rods, much enlarged. (After Pergande, U. S. Dep't Agric. Div. Ent. Tech. Ser. 9, 1901)



Fig. 173 Hormaphis hamamelidis: *a*—young larva; *b*—pupa; *c*—spring migrant; *d*—antenna, much enlarged. (After Pergande, U. S. Dep't Agric. Div. Ent. Tech. Ser. 9, 1901)

considerable numbers awaiting the unfolding of the buds. The plant lice settle along the midrib and the lateral veins of the unfolding leaves, and soon cause a pale yellowish green discoloration on the upper surface. The few days old gall appears as a small blisterlike swelling on the upper side. It develops rapidly and in May is quite convex or slightly conical, with the opening on the under surface nearly closed. The young galls are greenish yellow with the tip more or less purplish. The fully developed gall is shown on plate 1, figure 7.

The dormant season is passed as a winter egg deposited on the

branches of twigs, generally near the base of buds or leaf scars. The eggs resemble those of the common apple plant louse, Aphis mali Fabr., though they are considerably smaller. The young stem mother is but slightly larger than the egg and appears in the latitude of Washington about the middle of April. She is a dull black color covered with a

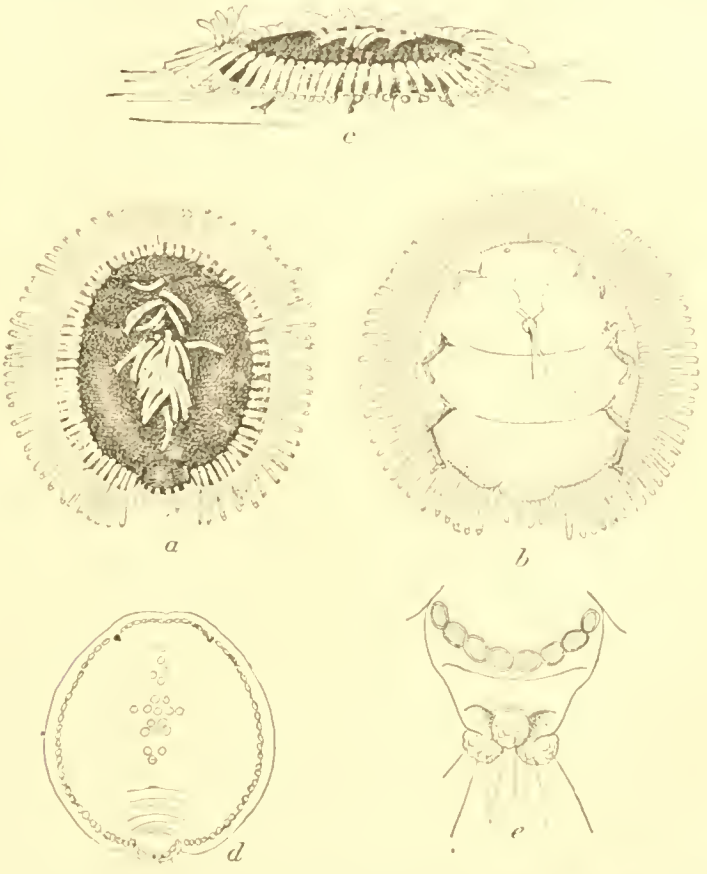
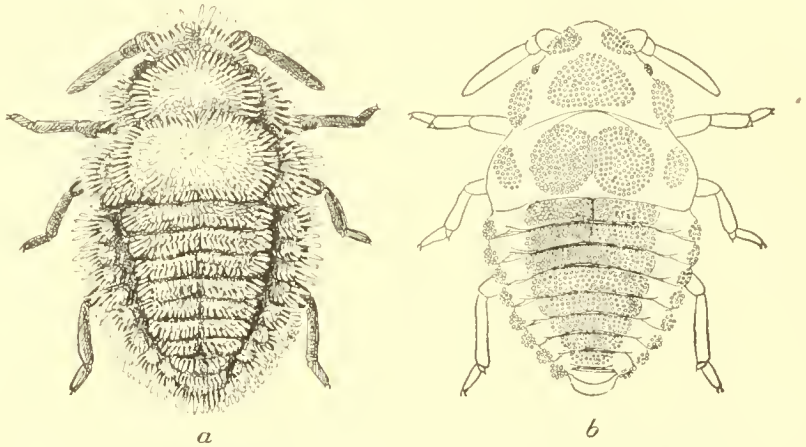


Fig. 174.—Hormaphis hamamelidis, d generation: c, stem mother; f, first-stage larva; a, dorsal view; b, ventral view; d, lateral view; e, fourth-stage larva, showing the arrangement of spines; e, end of body. (After Pergande, U. S. Dept. Agr., Div. Ent. Tech. Ser. 3, 1901.)

delicate, slightly bluish secretion and ornamented with a waxy secretion as shown in figure 172. She molts three times, attaining maturity the middle of May and from then producing 4–6 young till about the middle of June.

The second or winged generation, the young of the stem mother, com-

plete their growth within 16 to 20 days. They emerge from the galls and migrate to birches toward the end of May or early in June. The various forms of this generation are shown at figure 173. These plant lice live on the underside of birch leaves, sometimes covering them. Their young are met with in the vicinity of Washington early in June, attaining maturity in about 14 days. This generation has a characteristic appearance in its fourth stage, as shown in figure 174. It is remarkable because of its almost perfect mimicry of certain Aleurodids. The insects are first pale brownish, changing gradually to a dusky or black color. The fourth and fifth generations are essentially identical with the third, the last named attaining



a *b*

Fig. 175 Hormaphis hamamelidis, 6th generation, second stage: *a*=dorsal view; *b*=dorsal view denuded, showing arrangement of pores, much enlarged. (After Pergande, U. S. Dep't Agric. Div. Ent. Tech. Ser. 9, 1901)

maturity about the middle of August. It gives birth to a sixth generation which presents an entirely different form, as shown at figure 175.

The young are yellowish brown at first, naked, but soon become covered with a pruinose or bluish white secretion, giving them a moldy appearance. Later the bristly white iridescent waxy threads develop. This generation acquires wings, feeds for a time and then forsakes the birch, migrating back to the witch-hazel, where the sexual generation is developed. This latter sometimes becomes exceedingly abundant. The general characters of this generation are well illustrated at figure 176. Each female produces from

five to 10 eggs deposited as previously stated, and thus the life cycle of this extremely interesting form is completed.



Fig. [illegible] [illegible] *c*—fem. *c*, much enlarged. (After Pergande, U. S. Dept. Agric. Div. Ent. Tech. Ser. [illegible])

Spiny witch-hazel gall

Hamamelistes spinosus Shimer

Many spined, green or reddish galls occur on witch-hazel from June to the latter part of October.



Fig. 177 Hamamelistes spinosus: *a* winter egg much magnified; *b* twig of witch-hazel with young flower buds and eggs in position, natural size. (After Pergande, U. S. Dep't Agri., Div. Ent. Tech. Ser. 2, 1901)

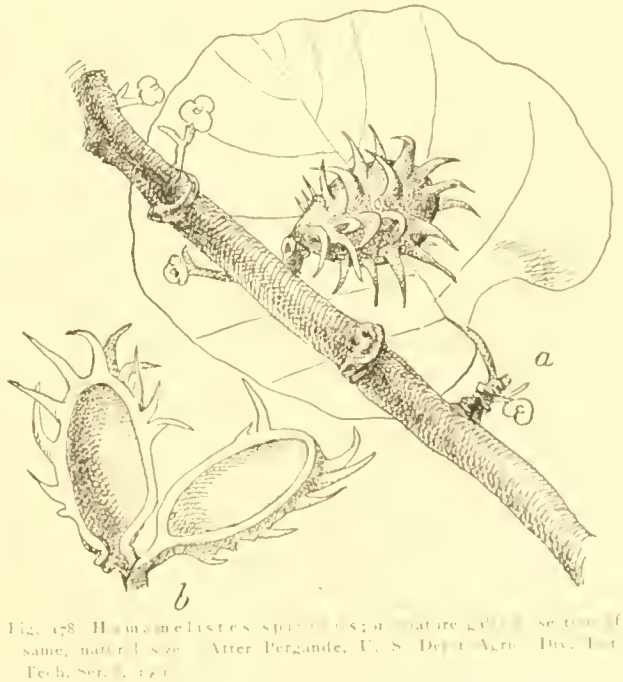


Fig. 178 Hamamelistes spinosus; *a* mature gall, reduced to one-half of same, natural size. (After Pergande, U. S. Dept. Agric. Div. Ent. Tech. Ser. 2, 1901)

Our knowledge of this insect is due almost entirely to long continued patient investigations by Theodore Pergande of the Bureau of Entomology.

United States Department of Agriculture. The following is a brief abstract of his detailed account: Winter eggs are deposited in rough places on the stems of witch-hazel, from the middle of June to early in July and remain unhatched till the following May or June, thus being dormant almost 12 months. The egg is quite flat, about $^{1}/_{125}$ inch long and is covered with a glistening, hairlike secretion harmonizing well with the twigs [fig. 177]. The recently hatched young are yellowish green and densely pubes-

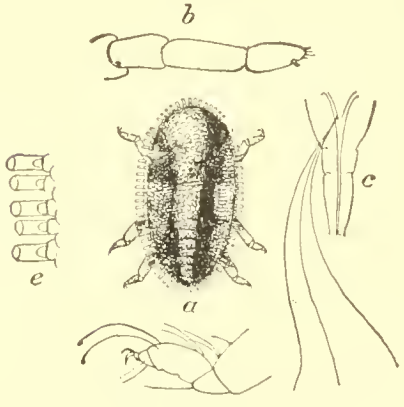


Fig. 179 Hamamelistes spinosus, 3d generation: *a*=hibernating larva; *b*=antenna; *c*=rostrum or beak; *d*=tarsus; *e*=lateral tubercles and waxy rods, much enlarged (After Pergande, U. S. Dep't Agric. Div. Ent. Tech Ser. 9, 1901)



Fig. 180 Hamamelistes spinosus, 3d generation: *a* dorsal view of adult female; *b* lateral view; *c*=ventral view; *d*=antenna; *e*, *f*, and g=legs, much enlarged (After Pergande, U. S. Dep't Agric. Div. Ent. Tech. Ser. 9, 1901)

cent or hairy and almost invariably locate on the side of buds next the twig. The irritation caused by the insect checks the growth of the petiole and hastens that of the bud, specially on the side opposite the insect, which lengthens, broadens, curves over the gall maker and soon assumes a beautiful rosy color. The plant louse is completely inclosed in a few days, only a transverse scar and small opening where the insect settled, remaining. The gall is now globular and hardly larger than the original bud. It develops rapidly and by the middle of June is about half grown, chang-

ing from rosy to a pale dingy color. The general form and structure is shown at figure 178. The young of the stem mother or the second generation attain maturity early in July and commence leaving the galls, continuing to issue till late in the fall. They migrate to birches where they settle on the leaves and each female produces from 30 to 40 or more young. This, the third generation, is peculiar in its resemblance to the

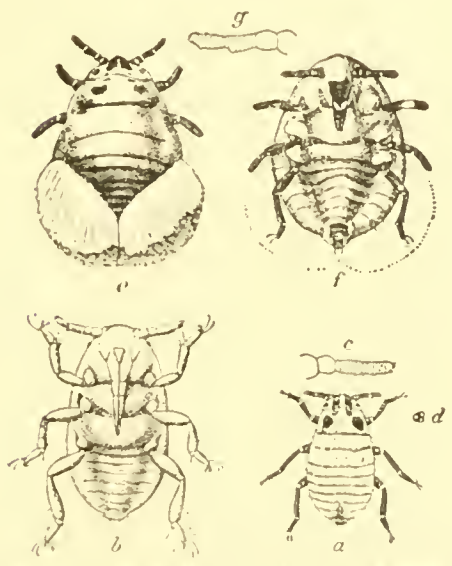


Fig. 181. [illegible] ×48. (After Pergande, U. S. Dep't Agric. Div. Ent. Tech. Ser. 17.)



Fig. 182. [illegible] pseudogalls or cocoonings on birch leaves, natural size. (After Pergande, U. S. Dep't Agric. Div. Ent. Tech. Ser. 17.)

young of a Lecanium [fig. 179]. The recently hatched young are reddish brown, with pale yellow legs and antennae and purplish eyes. They soon change to a brilliant dark metallic blue green. The adult female is broadly oval, deep black, convex [fig. 180]. This insect hibernates on the birch twigs, becoming covered with a waxy secretion. Activity is resumed the middle of April, when the females become full grown and produce young, the fourth generation. These latter are remarkable insects with their

conspicuous waxy tufts [fig. 181]. They settle in folds on the underside of the developing leaves and produce pseudogalls caused by the area between the veins bulging and forming ridges or corrugations [fig. 182].

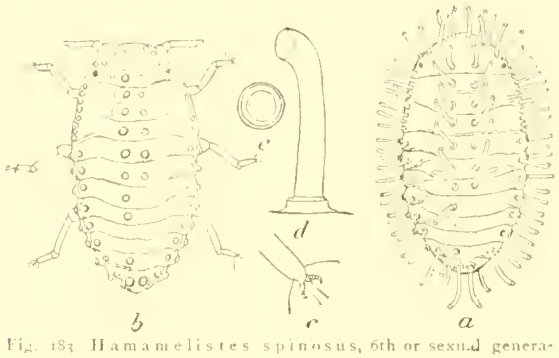


Fig. 183 Hamamelistes spinosus, 6th or sexual generation: *a*—dorsal view of young larva; *b*—the same denuded; showing arrangement of pores; *c*—tarsus; *d*—lateral tubercle and waxy rod; *e*—apex of lateral tubercle, much enlarged (After Pergande, U. S. Dep't Agric. Div. Ent. Tech. Ser. 9, 1901)

These galls are reddish brown, soon changing to reddish or crimson. The young attain their growth by the end of April or early in May and then produce a fifth generation, which is sometimes abundant enough to seriously injure the trees. This latter, on attaining its development, migrates early in June back to the witch-hazel, where the sexual generation [fig. 183] is produced and the life cycle of the species completed. This last develops rapidly, attaining maturity in two or three weeks and deposits eggs as stated

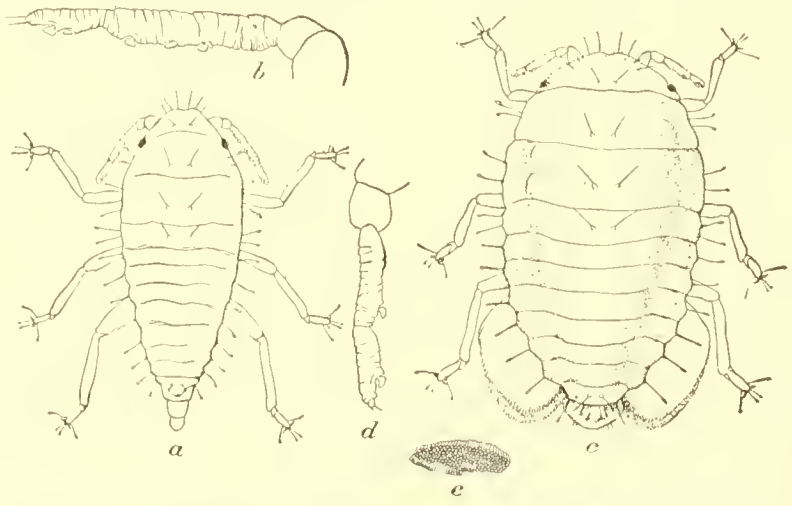


Fig. 184 Hamamelistes spinosus: *a*—dorsal view of male; *b*—antenna; *c*—dorsal view of female; *d*—antenna; *e*—ventral-lateral secretory gland, much enlarged (After Pergande, U. S. Dept. Agric. Div. Ent. Tech. Ser. 9, 1901)

above. The general appearance of the full grown males and females is shown at figure 184.

Birch seed gall midge. *Oligotrophus betulae* Winnertz. Deformed catkins of white birch produce enlarged seeds, each containing a reddish, legless maggot.

This European species is rather common about Albany and is of interest because of the peculiar deformity it produces in birch seeds. The larvae become full grown early in October, at which time a windowlike spot is easily discerned on the surface of the seed. The normal alate or winged seed is transformed by this insect into a nearly globular form with the alae rudimentary.

Sumac tomato gall. *Pemphigus rhois* Fitch. Somewhat pear-shaped or round, reddish galls of different sizes occur on sumac leaves in September.

These galls are rare in the vicinity of Albany. They are quite variable, round, spheroid in form, with the surface uneven and usually slightly knobby. The face exposed to the sun is normally bright crimson and the interior is sometimes thickly crowded with plant lice. These galls occur on Rhus glabra and R. typhina. [*See* pl. 49, fig. 3.]

Hackberry nipple gall. *Pachypsylla celtidis-mamma* Riley. This gall is represented by a cup-shaped depression on the upper side of the leaf; beneath it is broadly rounded and about $\frac{1}{4}$ inch in diameter. It is common on hackberry.

Rose root gall. *Rhodites radicum* Osten Sacken. This large, smooth, reddish brown gall occurs on the roots of various wild roses. It is deeply incised at the point of attachment to the roots. The interior is pithy and contains numerous cells.

Rose bedegar. *Rhodites rosae* Linn. Curious, curved, fibrous, mosslike masses occur on rose and blackberry bushes. This peculiar gall is composed of a mass of hard cells formed around a branch and is entirely covered with long, dense, green filaments forming a mosslike mass 1½ inches or more in diameter.

Mealy rose gall. *Rhodites ignota* Osten Sacken. Irregular, spheric galls about the size of a pea, covered with a white mealy substance, are rather common on wild rose in the vicinity of Albany. Occasionally several of these galls coalesce, forming an elongated, irregular mass. The gall is a woody one and contains several cells.

Spiny bullet gall. *Rhodites bicolor* Harr. Round galls a third to nearly half an inch in diameter, covered with prickly spines about as long as the diameter of the galls, are common on twigs of different kinds of wild roses. This gall is yellowish green sometimes tinged with red and occurs in clusters of two or more.

Globular rose gall. *Rhodites globulus* Beut. A smooth, rounded gall arising abruptly at each end from the branch, occurs on wild rose on Staten Island. It has a rather soft corky texture and contains numerous cells. It

is more or less oblong or almost round and measures from $\frac{3}{4}$ to $1\frac{1}{2}$ inches in length, being about $\frac{3}{4}$ inch in diameter.

Long rose gall. *Rhodites dichlocerus* Harr. This elongate, hard, woody gall, gradually tapering at both ends, occurs on the branches of wild roses. It has been taken on Staten Island and Dr Smith records it from New Jersey.

Knotty rose gall. *Rhodites verna* Osten Sacken. This gall, which is somewhat allied to the long rose gall, R. dichlocerus Harr., occurs on wild rose. It is oblong or rounded and about $\frac{1}{3}$ inch long, and occasionally, three or four galls are more or less fused. This species has been taken by Mr Beutenmuller on Staten Island.

LESS DESTRUCTIVE INSECTS AFFECTING EVERGREEN OR CONIFEROUS TREES

This group, comprising insects of minor importance found on our evergreen trees, is rather small because of the peculiarly close association existing between bark borers and species found with them, making it advisable in certain instances at least, to notice comparatively unimportant forms frequently met with in the burrows of destructive species.

Borers in trunk and limbs

Pine, species affecting

Large, white, fleshy, flat-headed borers $1\frac{1}{2}$ inches long occur under pine bark in long, narrow, very shallow grooves in the surface of the wood, transforming to a dark metallic gray, flattened beetle 1 to $1\frac{1}{4}$ inches long

Larger flat-headed pine borer, Chalcophora virginiensis, p. 653

A similar borer working in about the same way and transforming to a brilliant, coppery colored, flattened beetle about $\frac{3}{4}$ inch long

Smaller flat-headed pine borer, Chalcophora liberta, p. 654

A brilliant, sparkling, copper-red beetle a little over $1\frac{1}{2}$ to nearly $1\frac{3}{4}$ inches long occurs on pine and spruce..... Golden Buprestis, Buprestis striata, p. 655

An obscure, coppery or black, flattened beetle about $\frac{1}{2}$ inch long on pitch pine

Dicerca punctulata, p. 656

A brassy, metallic, flattened beetle about $\frac{5}{8}$ inch long occurs in midsummer on pine and arbor-vitae..... Dicerca tuberculata, p. 656

An ashy bronze or obscurely bronze, flattened, metallic beetle from a little over $\frac{1}{2}$ to nearly $\frac{3}{4}$ inch long occurs on white pine from midsummer to October

Dicerca tenebrosa, p. 657

An oblong, oval, flattened, bronze or purplish beetle, copper-colored beneath and $\frac{1}{2}$ inch long occurs on hard pine..... Chrysobothris dentipes, p. 657

A modestly colored, flattened beetle about 3/8 inch long occurs in midsummer on hard pine branches..... Chrysobothris tlorieola, p. 658

A small, flattened beetle 1/4 inch long is abundant on hard pine from June till September Chrysobothris pusilla, p. 658

A large, stout, brownish beetle 1 1/4 inches long breeds in pine stumps Harris's Prionus, Tragosoma harrisii, p. 659

A large, brownish black, narrow beetle about 1 inch long occurs on pines in June and July Criocephalus agrestis, p. 659

A bluish, flattened beetle about 1/2 inch long occurs in early spring on pines Blue pine borer, Callidium antennatum, p. 660

A blackish brown beetle 1/2 to 5/8 inch long occurs late in May on pine Lesser pine borer, Asemum moestum, p. 661

A grayish brown, mottled beetle 5/16 to 1/2 inch long occurs on white pine Acanthocinus obsoletus, p. 662

A slender, grayish brown beetle about 3/4 inch long occurs on pine in July Xylotrechus sagittatus, p. 663

A small beetle 1/4 inch long with a dark head and thorax and lighter wing covers and antennae, occurs on pine..... Batyle suturalis, p. 663

A small, dark brown longicorn 1/4 inch long occurs on pine and willow in midsummer Pogonocherus mixtus, p. 663

A black beetle about 3/4 inch long sparsely clothed with white hairs and downy white spots on the wing covers, forming two irregular bands, occurs on pine Hylotrupes bajulus, p. 664

A dark chestnut-colored weevil 3/8 inch long occurs in May and June on pines or in mill yards..... Pales weevil, Hylobius pales, p. 664

A stout, brownish bark beetle about 3/16 inch long occurs under pine bark Pine Hylurgops, Hylurgops glabratus, p. 665

A jet-black beetle only 1/4 inch long and with silvery white markings on the wing covers, occurs in midsummer on pines..... Clerus quadriguttatus, p. 666

Spruce, species affecting

A conspicuous bluish black horntail about 1 1/4 inches long occurs on spruce White-horned Urocerus, Urocerus albicornis, p. 667

A large, black, 4-winged fly an inch long and having some resemblance to a wasp but with a stout, cylindric body, attacks spruce Banded horntail, Urocerus abdominalis, p. 668

A small horntail with a blue abdomen and rufous legs attacks spruce and fir Blue horntail, Paururus cyaneus, p. 669

A somewhat cylindric, black or brownish beetle about ½ inch long occurs in midsummer on spruce..... Tetropium cinnamopterum, p. 669

A black, red-shouldered, flattened beetle about 5/16 inch long occurs on spruce
Phymatodes dimidiatus, p. 669

A large, handsome, black beetle with the basal portion of the wing covers deep red and the middle antennal joints broadly ringed with reddish
Canadian Leptura, Leptura canadensis, p. 670

A cylindric brownish beetle about ½ inch long and ornamented with irregular, sulfur yellow bands, occurs on hemlock and spruce.. Xylotrechus undulatus, p. 671

A slender, whitish, wood-boring grub enters the wounds of living trees and bores deep into the sapwood and heartwood
Blazed tree borer, Serropalpus barbatus, p. 671

A small, narrow, triangular beetle about 3/16 inch long and irregularly marked with silvery white, occurs on spruce and decaying maple..... Mordella borealis, p. 672

A small, stout, nearly cylindric, brownish bark beetle about ⅛ inch long occurs in spruce bark..... Dryocoetes autographus, p. 672

A small, yellowish brown to almost black bark beetle occurs in spruce bark, particularly at the base of the limbs..... Cryphalus striatulus, p. 673

A minute, black or brown bark beetle excavates many short, radiating, curved galleries in young dying red and black spruce
Spruce wood engraver, Pityophthorus cariniceps, p. 674

Balsam, species affecting

A large, metallic, flattened, oval beetle about ¾ inch long occurs on balsam in July
Buprestis maculiventris, p. 674

Hemlock, species affecting

A rather slender, somewhat triangular beetle with a subtriangular spot near the middle of the outer margin of each wing cover, occurs on hemlock
Leptura subhamata, p. 675

Cedar, species affecting

A brownish beetle from 3/8 to nearly ½ inch long with two large, blue patches at the base of the wing, bores as a larva in cedar
Cedar tree borer, Hylotrupes ligneus, p. 675

Leaf feeders

Pine, species affecting

Loose web nests thickly sprinkled with excrement, occur on the terminal twigs and contain greenish or brownish false caterpillars... False pine webworm, Lyda species, p. 676

Loose web nests with considerable brown excrement on the needles of terminal pine twigs contain true caterpillars..... Pine web worm, Bena malanogrammos, p. 676

A large, thick, pale green caterpillar, 3 to 4 inches long, with pale orange head and legs and 6 spined, yellow tubercles behind the head, occurs on white pine late in August and through September..... Imperial moth, Basilona imperialis, p. 677

A grass green, yellow and white striped caterpillar feeds on pine in the middle of September..... Harris's pine hawk moth, Lapara bombycoides, p. 679

A dull red caterpillar banded with brighter red with a light lateral line and reddish hairs in clusters, occurs on pine in late August and September

White pine tufted caterpillar, Panthea furcilla, p. 679

A dull rusty brown, irregularly white-spotted, flattened caterpillar with series of grayish tufts on each side harmonizes very closely with the bark

Larch lappet, Tolype laricis, p. 680

A small, cylindric larva mines the leaves of various pines

Pine leaf miner, Paralechia pinifoliella, p. 681

Peculiar tubes of webbed-together pine needles occur in midsummer and September on white and probably other pines..... Pine tube builder, Eulia politana, p. 681

Short, stout beetles from $\frac{1}{3}$ to nearly $\frac{1}{2}$ inch long are numerous on hard pine foliage the latter part of June and throughout July

Light-loving grapevine beetle, Anomala lucicola, p. 682

A light brown beetle less than $\frac{1}{3}$ inch long is rather common on hard pine from the latter part of June till the last of August..... Metachroma marginalis, p. 682

Spruce, species affecting

Pale green, false caterpillars feed singly on spruce the latter part of the summer

Spruce sawfly, Pteronus integer, p. 683

A red-headed, brownish caterpillar about $\frac{5}{8}$ inch long feeds on young, fresh spruce cones..... Spruce cone worm, Dioryctria reniculella, p. 684

Balsam, gall fly affecting

A small midge produces an oval enlargement near the base of balsam needles

Balsam gall midge, Cecidomyia balsamicola, p. 685

Sucking insects

Pine, species affecting

A small, grayish and brown plant bug $\frac{1}{5}$ inch long occurs on hard pine and other trees and shrubs..... False chinch bug, Nysius angustatus, p. 685

A small, brown plant bug $\frac{1}{4}$ inch long..... Phytocoris eximius, p. 685

Pilophorus crassipes, p. 686

A brownish, membranous, winged plant bug a little over 1/4 inch long
Oliarius quinquelineatus, p. 686

Small, stout, triangular or rounded bugs producing masses of frothlike spittle on pines
Spittle insects, several species, p. 686

A greenish brown leaf hopper about 5/16 inch long.. Stictocephala inermis, p. 687

A small, active, rather slender plant bug about 1/4 inch long with yellowish head and prothorax and yellowish red wing covers occurs on hard pine in midsummer
Dichrooscytus rufipennis, p. 687

A light brown, slender plant bug about 1/4 inch long with the thorax variously marked with red, pinkish and light brown occurs on hard pine
Nabis rufusculus, p. 688

A grayish, yellowish or red-marked, elliptic insect, about 1/2 inch long occurs the latter part of summer on hard pine, many shrubs and plants
Gypona octolineata, p. 688

A small, reddish brown, jumping plant louse 1/8 inch long abounds on hard pine the latter part of the season and in early spring
Bramble flea louse, Trioza tripunctata, p. 688

A conspicuous snow-white, woolly scale is sometimes very abundant on the more tender growths of pitch and southern yellow pine
Woolly pine scale, Pseudophilippia quaintancii, p. 689

Hemlock, species affecting

An oval, dark gray often blackish scale with a lighter margin, occurs on hemlock, pine, fir and maple..... Hemlock scale, Aspidiotus abietis, p. 690

Frequenters of evergreen or coniferous trees

A brilliantly marked, brick-red and blue ground beetle about 3/4 inch long
Lebia grandis, p. 690

A yellowish, 9-spotted hemispheric beetle
Nine-spotted lady beetle, Coccinella novemnotata, p. 691

A yellowish, almost black banded hemispheric beetle
Three-banded lady beetle, Coccinella trifasciata, p. 691

A black beetle about 1/4 inch long with a conspicuous orange band containing two circular black spots on the basal two thirds of the wing covers
Ips sanguinolentus, p. 691

A shining black beetle about 1/4 inch long with four irregular, orange markings on the wing covers..... Ips quadriguttatus, p. 692

A small, snapping beetle less than 3/8 inch long with a light head and light yellowish elytra marked with dark brown..... Corymbites propola, p. 692

A small, snapping beetle about 1/2 inch long with its yellowish wing covers thickly marked with curved, dark brown or black lines . Corymbites hieroglyphicus, p. 692

A small, black clerid with wing covers marked with zigzag black and gray transverse bands occurs on spruce
Cloudy bark beetle destroyer, Thanasimus nubilus, p. 693

A small beetle 1/4 inch long with pale yellow irregularly mottled wing covers and black head and thorax..... Hydnocera pallipennis, p. 693

A jet-black, slender beetle nearly 1/10 inch long occurs on late scrub growths
Hydnocera humeralis var. cyanescens, p. 693

A small, variable, somewhat elongated, brown beetle about 1/4 inch long
Ernobius mollis, p. 694

A greenish, coppery, elongate, parallel-sided beetle about 1/2 inch long
Dichelonycha albicollis, p. 694

A thick, cylindric, brilliant brassy, coppery hued, rather stout beetle
Pine Chrysomela, Glyptoscelis pubescens, p. 695

A stout, yellowish brown beetle a trifle over 1/3 inch long
Cryptocephalus schreibersii, p. 695

A small, stout, black, red-spotted beetle 1/8 inch long
Cryptocephalus quadrimaculatus, p. 695

A small, brown or blackish beetle, 1/8 inch long, with lighter transverse bands on the wing covers and a conspicuous pronotal process..... Notoxus bifasciatus, p. 696

A small, brown, black-marked beetle about 1/8 inch long with a conspicuous pronotal process..... Notoxus anchora, p. 696,

A yellowish brown, black-dotted, somewhat oval plant bug 3/4 inch long
Coenus delius, p. 697

Delicate, greenish or brownish lace-winged flies with golden eyes, occur on many plants
Lace-winged flies, Hemerobius stigmaterus, p. 697
Micromus montanus, p. 697

Slender, pale green or greenish white, cricketlike creatures
Flower or tree crickets, several species, p. 698

Larger flat-headed pine borer

Chalcophora virginiensis Drury

Large, white, fleshy, flat-headed borers 1 1/2 inches long occur under pine bark in long narrow, very shallow grooves in the surface of the wood, transforming to a dark metallic gray, flattened beetle 1 to 1 1/4 inches long.

This large, white, fleshy, flat-headed borer about 1 1/2 inches in length may be met with under pine bark, where it inhabits long, narrow and very

shallow grooves in the surface of the wood. The irregular, wavy or serpentine galleries enlarge with the growth of the larva and differ in general appearance from the borings of other insects inhabiting similar situations. This, the largest of the flat-headed pine borers, was met with rather commonly by the writer on hard pine at Karner in 1901 from early in June to the latter part of September. The record of captures is as follows: June 4, two; June 13, two; June 26, four; July 8, two; August 9, two and September 18, one. The beetle may be found resting on the sunny side of the trunks and branches and occasionally among the needles of the smaller twigs. It is probably attracted by light, since one was taken in a trap lantern. The adult is a dark metallic gray colored beetle measuring from 1 to $1\frac{1}{4}$ inches in length.



Fig. 138. Chalcophora virginiensis, enlarged (original)

Dr Packard states that the beetles appear in the Northern States toward the end of May and occur through the month of June, according to Harris, while he observed them in Maine on pinetrees in the middle of July. Dr LeConte records this species as abundant in the Middle, Eastern and Southern States and adds that this form may be readily distinguished by its dull color, fine punctuation of the depressed spaces of the wing covers, of which the four impressed spaces are better defined than any others, and finally by the sides of the thorax being anteriorly rounded to the middle and not at all angulated.

Smaller flat-headed pine borer

Chalcophora liberta Germ.

This species may be distinguished from C. virginiensis Drury by its smaller size, it ranging from about $\frac{3}{4}$ inch in length, and by the brilliant coppery color which is usually much more marked than in C. virginiensis.

It was taken by the writer in relatively small numbers on hard pine at Karner in 1901 as follows: June 4, one; June 13, four; September 6, one and October 3, one. Dr Fitch states that this species is much more com-

mon in eastern New York than the larger C. virginiensis Drury though such has not been our experience. He instances a small growth of young pines, only a few rods in extent, where upwards of 100 specimens of this beetle were taken in the middle of September, one or two being found on almost every tree in the grove, while only six of C. virginiensis Drury were met with.

This smaller form, according to our observation, is present in the adult stage rather more abundantly late in the fall and this may be the reason why Dr Fitch failed to meet with more of the larger beetles. Dr Fitch states that he found the insects mostly at the tips of the limbs, clinging to the leaves with their heads inwards, the position in conjunction with shape and size giving them a close resemblance to the young fruit cones growing from the same points on several of the limbs. He adds that they appeared to be eating the young buds, which are probably the food on which all these beetles subsist in the perfect state.



Fig. 186 Chalcophora [illegible], adult, enlarged (Original)

Dr LeConte has recorded this species as abundant in the Middle and Eastern States and adds that it varies slightly in color, but is usually of a fine golden copper tint. He states that the broadly rounded sides of the thorax, the deep dorsal grooves and the entire sutural striae are characteristic of this species.

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Golden buprestis

Buprestis striata Fabr.

A brilliant, sparkling, copper-red beetle a little over ½ to nearly ¾ inch in length, occurs on pine and spruce trees in May and June.

This handsome, flat, metallic beetle was noticed by Dr Fitch about a half century ago. It appears to infest the dead wood of logs and stumps. The

adults are said to feed on the tender buds of pine and spruce. This insect, according to Dr Saunders, is a very handsome beetle from 6/10 to 7/10 inch long, of a coppery red color, with a broad, bluish green stripe on each wing cover, which varies in brilliancy in different specimens. There are four raised, smooth lines on each wing cover and a wide, shallow groove along the middle of the thorax. Both thorax and wing covers are pitted with minute dots. Dr LeConte records this species from the Middle States, Canada and Lake Superior.

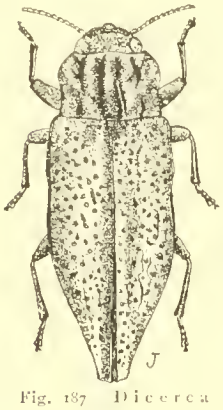


Fig. 187 Dicerca punctulata, enlarged (original)

Dicerca punctulata Schonherr

An obscure, coppery or black bronze, flattened beetle about 1/2 inch long, occurs on pitch pine.

This buprestid was rare at Karner in 1901, only two specimens being taken, one in June and the other in August. Dr Fitch states that this species may be recognized by the smooth, transverse elevation on its front, extending from eye to eye, The wing covers taper to a rounded, nearly truncate tip.

Dicerca tuberculata Chev.

A brassy, metallic flattened beetle about 5/8 inch in length, occurs in midsummer on pine, arbor-vitae and probably some other evergreens.

This species was taken on arbor-vitae July 6, 1903, at Big Moose. It is a brassy colored species, having coarse, rough, irregular marks. The rows of coarse punctures on its wing covers are about equally distant from each other instead of being in pairs. The intervening spaces have many irregular, elevated, black, polished spots, and the elevated, transverse lines upon the front are interrupted and not very prominent. LeConte states that the terminal segment of the male is truncate, emarginate, with tibiae simple, while in the female the last segment is rounded apically. This species has been recorded from Maine and, as stated above, occurs in New York. Blanchard records it from Massachusetts.

Dicerca tenebrosa Kirby

An ashy bronze or obscurely bronze, flattened, metallic beetle from a little over ½ to nearly ¾ inch long occurs on white pine from midsummer to October.

This insect has been described by LeConte as follows:

Ashy bronze or obscurely bronze, the prothorax dilated on the sides, which are rounded in front, sinuous behind, coarsely punctured; behind broadly excavated on each side, with apical and basal shining smooth rugosities; a definite dorsal deep furrow with smooth sides, somewhat interrupted in the middle; elytra densely punctured, with alternate oblong, raised, shining interstitial spaces, prolonged entire to the apex; length .57 to .75 inch. Male with the pectus broadly sulcate, villose; the intermediate tibiae armed with an internal acute tooth; the last ventral segment truncate emarginate. Female with the pectus smoother, less sulcate; the last ventral segment tridentate; the intermediate tooth obtuse, defined by minute incisions.

LeConte also adds the following regarding this species:

The under surface is copper-colored, coarsely and densely punctured on the sides, abdomen and prosternum, less densely on the metasternum and middle of the first segment of the abdomen; the divided portions of the mesosternum are coarsely and tolerably densely punctured. The outer costae of the thorax are interrupted so as to form on each side an apical and basal callosity. A female from Newfoundland differs by the epipleurae being green, the under surface of the prolonged extremity of the elytra blue, and by the incisures between the anal teeth being more widely separated.

Beetles belonging to this species were taken in July on arbor-vitae at Big Moose, and a specimen found in June 1900, at Saranac Inn. It is recorded as being abundant at Lake Superior, and according to Kirby, has been taken in latitude 65° in the Rocky mountains. The beetle has also been taken under the bark of white pine in the Adirondacks by Mr George Hunt. Mr Blanchard records finding it in Massachusetts on spruce wood piles and logs in June and also lists it from New Hampshire.

Chrysobothris dentipes Germ.

An oblong, oval, flattened, bronzed or purplish beetle, copper-colored beneath and about ½ inch long, occurs in small numbers on hard pine.

This species was somewhat rare on hard pines at Karner in 1901. It is similar in coloration to C. floricola Gory, though it is considerably

larger [pl. 20, fig. 11]. Dr Harris states that this species issues from the trees between the end of May and the first of July. It may be recognized by the aid of the above characters and the following: The thorax is not so wide as the hinder part of the body and its posterior margin is hollow on both sides to receive the rounded base of the wing covers, on each of which there are three irregular, smooth, elevated lines divided and interrupted by large, thickly punctured, impressed spots, two of which are oblique. The larva makes a slender, winding, serpentine gallery between the bark and the wood of newly felled trees and presents the usual buprestid characters. This species is reported as rather common on pine wood and timber in Massachusetts, though not so abundant as C. floricola Gory. It occurs in Canada and the northern United States.

Chrysobothris floricola Gory.

A modestly colored, flattened beetle about 3/8 inch long occurs in midsummer on hard pine branches.

This modestly colored buprestid about 3/8 inch long [pl. 20, fig. 10] occurred at Karner on hard pine branches and young needles from the 13th of June to the latter part of August 1901. It ranges from Florida through the Middle States probably into Canada.

Chrysobothris pusilla Lap. & Gory

A small, flattened beetle 1/4 inch long is abundant on hard pine from June till September.

This small buprestid 1/4 inch long [pl. 20, fig. 9], was very abundant on hard pine at Karner early in June till the first part of September 1901. The blue abdomen, uncovered when the insect is in flight, glistens brightly in the sunshine. This is a common pine insect ranging from North Carolina probably to Canada and westward to Wisconsin.

Harris's Prionus

Tragosoma harrisii Lec.

A large, stout, brownish beetle about 1¼ inches in length, and closely resembling a rather slender prionid, breeds in pine stumps.

This species, according to Wickham, is considered by some writers as identical with the North European T. depsarium Linn. He characterizes it as a curious looking beetle of elongate form and brownish color. The antennae are slender, the prothorax small in comparison with the elytra, very hairy and armed on each side with a single sharp tooth, in front of which the lateral margins are convergent. The elytra are shining, distinctly punctured and with numerous raised lines.

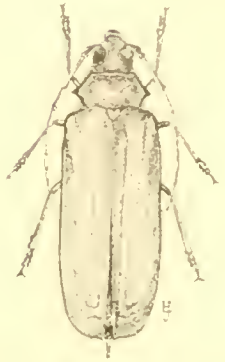


Fig. 188. Tragosoma harrisii, enlarged (original)

This species probably ranges across the continent in the more northern latitudes, having been reported from Fort Colville Wash. Leng records it from Newfoundland to Vancouver and Coney Island. The state collection contains a specimen taken by Erastus Corning at Murray Bay, Province of Quebec, in July or August, and it has also been captured in the pine forests of the Adirondacks.

Criocephalus agrestis Kirby

A large, brownish black, narrow beetle about 1 inch long occurs on pines in June and July, its white footless grub boring therein.

The adult insect is a large, brownish black, narrow beetle about 1 inch in length. It may be recognized by the pair of deep thoracic impressions, the fine punctures on the elytra and by the third joint of the hind tarsi being two thirds longer than wide, emarginate for about one half its length. This beetle closely resembles Asemum moestum Hald., though twice as large and with longer, more slender antennae. This species is evidently very abundant in Quebec, since a large series was taken at Murray Bay by Erastus Corning in July or August 1878. It occurs in New York

State, has been recorded as infesting the roots of pine and spruce, and is evidently widely distributed in the northern United States and Canada.

Blue pine borer

Callidium antennatum Newm.

A bluish, flattened beetle about ½ inch long, is common in early spring on pines.

This pretty borer was bred in large numbers from a young dead pine taken at Karner, Ap. 17, 1903, at which time larvae, pupae and adults were present.

Description. The beetle may be easily recognized by its blue or violet color and black antennae and legs. It is about ½ inch long, flattened, eyes coarsely granulate, strongly emarginate, almost divided; thorax broad, rounded laterally; wing covers rather coarsely corrugated. This species may be separated from the closely allied C. janthinum Lec., according to Wickham, by the impressions on the thorax and its finer punctures.

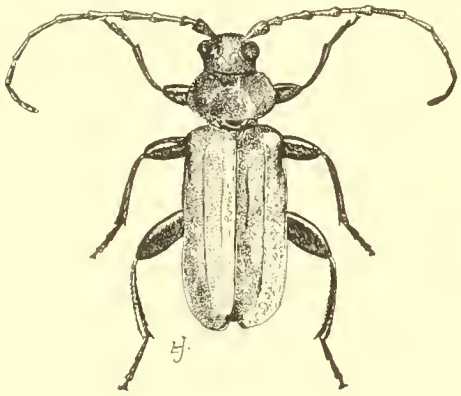


Fig. 189 Callidium antennatum, enlarged (original)

Life history. The beetles occur in early spring, at which time they may be cut out of their burrows or collected from pine foliage. The boring by the larva is somewhat characteristic, being a broad, wavy channel just under the bark and largely confined to wood that is quite dry. Frequently considerable proportions of the sapwood are eaten away, so that only ridges remain as illustrated on plate 61, figure 3. The life cycle is probably completed in one year.

Food plants. This insect is a common borer of the pine, and has also been recorded from red cedar. Dr Walsh was of the opinion that the cedar-inhabiting form was simply a phytophagic variety.

Distribution. This insect probably has an extended distribution in America, since it has been recorded in various local eastern lists, and from

California, ranging as far south at least, as West Virginia. It probably occurs in most places where pine grows.

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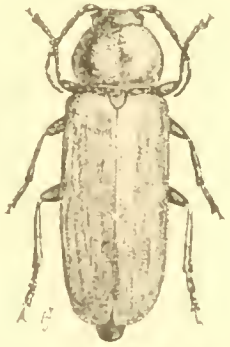
Lesser pine borer

Asemum moestum Hald.

A blackish brown beetle ½ to ⅝ inch long occurs late in May on pine.

The larva of this species makes flattened, cylindric holes or mines which perforate the trunk of white pine and other trees in all directions. It is rather small, and the blackish brown beetle, about ½ to ⅝ inch in length, appears late in May. We have met with this small borer on hard and white pine in May. Dr Packard states that this species appears to attack healthy as well as diseased trees, and cites several instances of injurious work. He finds that the exit holes are usually most abundant on the south side of the tree or stump, and that in some cases they are very numerous, as many as 10 occurring in a space of five square inches. The larval gallery is deep, extending 6 or 8 inches toward the heart of the tree, where it ends in an oval pupal cell.

Description. The larva has been described in detail by Dr Packard, who states that it is about ½ inch long, and that the prothorax inclines downward toward the head, being long and no wider than the mesothoracic or metathoracic segments. Abdominal segments rather broad, and on the two hinder thoracic and first abdominal segments are transverse, regular, oblong areas banded by impressed lines. On segments two and four the callosities are narrower and pointed anteriorly, on six and seven they are a little longer than broad, contracted posteriorly. Smaller callosities occur on the ventral surface. The true legs are minute, three-jointed, small and rather short.



The pupa is flattened, nearly ½ inch in length, somewhat broad and

may be readily distinguished from other pupae of the genus, by the short antennae not extending to hinder edge of the metathorax, and the component segments being much shorter than in other species. The two raised, longitudinal lines of the wing covers corresponding to those of the beetle are very characteristic. The end of the abdomen is square and terminates in two sharp, slender, incurved hooks which are dark red at the tip.

The adult is a rather stouth, blackish or very dark brown beetle from ½ to 5⅝ inch in length. The short antennae do not extend to the hind edge of the metathorax, the prothorax is short with rounded sides, and the elytra are marked by two conspicuous ridges.

Food plants. Dr Hopkins states that this species works at the base of dying pine and spruce trees, hastening their death and decay. Mr Beutenmuller records this species as occurring upon oak and grapevine as well as pine, spruce and other conifers.

Distribution. We have taken this beetle at Nassau and Troy N. Y., and it has been reported from Buffalo N. Y., Cincinnati O., southwestern Pennsylvania, District of Columbia, and Dr Smith states that the beetles occur throughout New Jersey, during May and June, and that the larvae may be found in pine.

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Acanthocinus obsoletus Oliv.

A grayish brown, mottled beetle 5/16 to ½ inch long, occurs on white pine.

The female of this species is remarkable because her long ovipositor extends about ⅜ inch beyond the tip of the abdomen. The delicate antennae are longer than the body, ringed with dull, yellowish white and the wing covers are marked with obscure, oblique, darker areas. It occurs in small numbers during July and August on white pine. This species has a wide distribution in the northern Atlantic region, according to Dr LeConte.

Xylotrechus sagittatus Germ.

A slender, grayish brown beetle about ¼ inch long occurs on pine in July.

A single example of this interesting borer was taken at the base of a dying white pine July 26, 1901 at Bath-on-Hudson. Dr Smith states that this species is generally distributed, though rare in New Jersey.

Batyle suturalis Say

A small beetle ¼ inch long with a dark head and thorax and lighter wing covers and antennae, occurs on pine.

This small longicorn, about ¼ inch long, may be recognized by its dark brown head and thorax, lighter wing covers and antennae. The head,

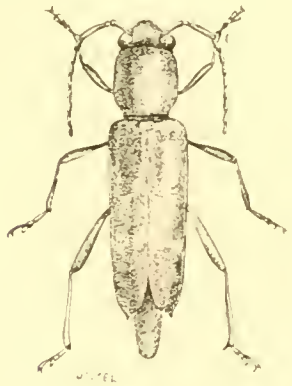


Fig. 191 Xylotrechus sagittatus, enlarged (original)

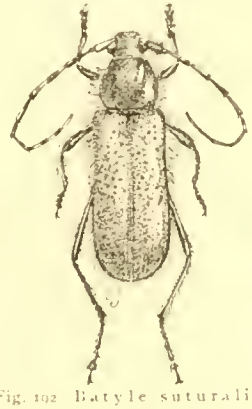


Fig. 192 Batyle suturalis, enlarged (original)



Fig. 193 Pogonocherus mixtus, enlarged (original)

thorax and wing covers are rather coarsely punctured and all, as well as the antennae, are clothed with stiff, somewhat sparse hairs. A single specimen was taken on hard pine at Karner, June 26, 1901.

Pogonocherus mixtus Hald.

A small, dark brown longicorn about ¼ inch long, occurs on hard pine and willow.

This beetle has a nearly black head and thorax, the latter with a conspicuous spine on each side and the wing covers are irregularly mottled with black or dark brown, brown or grayish. It is abroad during June and July and has been recorded as a willow borer.

Hylotrupes bajulus Linn.

A black beetle about ¾ inch long, with a gibbous prothorax sparsely clothed with white hairs, with shallow, confluent punctures and the elytra with downy white spots forming two irregular bands, occurs on pine and spruce.

This species appears to be rare in New York State, since we had no specimens in the collection prior to receiving a few beetles in June 1904 from Yonkers, where it was stated that they were emerging in some numbers from flooring, presumably spruce. Harris states that this is probably an introduced species, and that it is found in this country only near the seacoast.

Pales weevil

Hylobius pales Herbst.

A dark, chestnut-colored weevil ⅜ inch long, occurs in May and June on pines or in mill yards.

This beetle [pl. 20, fig. 8] lives under the bark of various pines and is widely distributed, ranging from Florida northward to Maine and Lake Superior. It occurs somewhat commonly on hard pines at Karner from June to the latter part of September.

Life history. The life history is summarized by Dr Packard as follows: The grubs make irregular galleries under white pine bark and later traverse the sapwood, transforming in autumn in pupal cells excavated in the latter. The insects protect their shelters with a thick roof of sawdust or chips and sometimes as many as eight or 10 cells may be found within an area of four square inches. The grubs remain till early spring in these retreats, transforming to pupae in March, the beetles appearing in May or June. The eggs are laid either in the sides of the old burrow or in crevices of the bark. We have taken adults as late as October 23 and it is probable that oviposition continues throughout the summer.

Pine Hylurgops

Hylurgops glabratus Zett.

A stout, brownish bark beetle about 5/16 inch in length, may be found working under pine bark during early spring and again in September.

A single example of this species was taken by us at Bath-on-Hudson, Sep. 26, 1901, from under the moist bark of a hard pine infested with Rhagium lineatum Kirby. The tree had evidently been killed by borers, and it is probable that this species had a part in the destructive work.

Description. This brownish black beetle is about 5/16 inch in length. The labrum bears a few golden yellow hairs at its lower extremity; the prothorax is rounded at the sides, narrowed anteriorly, and thickly and somewhat coarsely punctured. The wing covers are deeply striated, the striae being almost a series of confluent punctures. The posterior third of the elytra is sparsely clothed with rather coarse, yellowish hairs. The larva is a footless, curved, white grub, according to Packard.



Fig. 121 Hylurgops glabratus (enlarged)

Life history and habits. This borer was first noticed by Dr Fitch, who records it as occurring frequently on pine lumber in mill yards early in May, and who characterized it as the pine destroying Hylastes. Dr Packard has recorded finding the beetles under the bark of a white pine stump at Brunswick Me., Aug. 15–20, 1881. This species has been met with by Dr Hopkins of West Virginia, who states that it mines the green bark of pines, both at the base of dying trees and also in logs and stumps. He states that the adults were met with in early May (some entering the bark on the 18th), and the latter part of June, pupae occurring Oct. 4. Eggs were observed in early May, young larvae June 13, and full grown ones July 14.

Distribution. This species has been recorded by Dr LeConte, from

Lake Superior, Canada and Ohio, and it has been listed by Ulke from the District of Columbia, where it occurs on pine.

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Clerus quadriguttatus Oliv.

A jet-black beetle only 1/4 inch long and with silvery white markings on the wing covers, occurs in midsummer on pines.

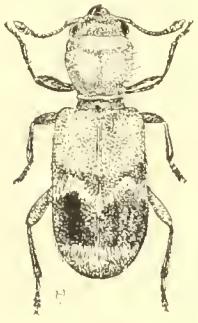


Fig. 195 Clerus quadriguttatus, enlarged (original)

This, one of our smaller beneficial species, is only 1/4 inch in length. The head, thorax and posterior portions of the wing covers are jet-black except for transverse, silvery white markings on the latter; the basal portion of the wing covers is reddish. This little beetle occurs rather commonly on hard and probably other pines infested by Tomicus or other borers, on which it undoubtedly preys. Adults were taken from the latter part of June throughout July. It is a common, somewhat abundant species in the northeastern United States.

Rhyncolus brunneus Mann.

This rather slender, jet-black beetle about 5/32 inch in length occurs under decaying pine bark. The head and thorax taper slightly anteriorly, are finely punctured and the wing covers coarsely striated with series of almost confluent, coarse punctures.

Synchroa punctata Newm.

This obscurely colored, brownish melandryid with the wing covers thickly clothed with a yellowish pubescence, is about 3/8 inch long and has been taken under the bark of white pine and maple. Larvae and pupae were found by Mr Young under maple bark at Ilion, May 31, the beetles issuing June 5.

Scymnus tenebrosus Muls. was beaten from pine at Karner July 27, 1901.

Cardiophorus gagates Er.

This species was taken on pine in June and probably lives under the bark of decaying trees.

Limonius confusus Lec.

This beetle was beaten in June from hard pine at Karner.

Callidium aereum Newm., *see* p. 450.

Leptura zebra Oliv., *see* p. 450.

Urographis fasciatus DeG., *see* p. 434.

Platydema subcostatum Lap.

This insect was taken under decaying white pine bark at Schuylerville in October.

Eustrophus repandus Horn. occurs under the decaying bark of white pine.

Rhinomacer pilosus Lec. was taken on hard pine at Karner, Ap. 15.

White-horned Urocerus

Urocerus albicornis Fabr.

A conspicuous, bluish black horntail about 1¼ inches in length may be observed upon spruce, or its thick, fleshy larvae may be found at work in the wood.

This species is a close ally to the common pigeon tremex so frequently observed on diseased or dying maples and elms, and has similar habits.

Description. The adult may be easily recognized on account of its resemblance to the pigeon tremex, p. 61, in connection with the following description by Dr Harris:

The white-horned Urocerus has white antennae, longer and more tapering than those of the pigeon tremex, and black at each end. The female is of a deep blue black color, with an oval white spot behind each eye, and another on each side of the hinder part of the abdomen. The horn on the tail is long, and shaped like the head of a lance. The wings are smoky brown, and semitransparent. The legs are black, with white joints. The body measures about an inch in length, and the wings expand nearly two inches.

Life history and habits. Adults of this species have been observed ovipositing on recently sawed spruce lumber, and Dr Hopkins states that it attacks spruce, hemlock and fir. This is one of the more common of our species in the eastern United States, though it is far from abundant and the male appears to be quite rare. The adults are usually found during July and August on the trunks of coniferous trees on bright days. The eggs are deposited in the wood with the stout ovipositor, the insects apparently preferring recently felled trees. The larvae run large burrows through the trunks, often rendering them unfit for lumber.

Distribution. This species has been recorded by Fabricius from both North and South America. It has in addition also been reported from the following localities: New England, New York, New Jersey, Louisiana, Washington, Ottawa Can., Lake Winnipeg, Newfoundland and Northwest Territory. It has also been taken in England, probably carried there in infested lumber. Some allied species are regarded as destructive to pine forests in Germany, and reports of considerable injuries to coniferous trees have been received from the Northwest Territory, though we believe that, as a rule, in this country comparatively little damage results from this insect's work.

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Banded horntail

Urocerus abdominalis Harr.

A large, black, 4-winged fly an inch long having some resemblance to a wasp, but with a stout, cylindric body, attacks spruce.

This species has smoky, transparent wings and its larvae have the general character of other horntails. The different sexes of these insects vary considerably, and it is possible that this species is the male of Urocerus albicornis Fabr. noticed above.

Blue horntail

Paururus cyaneus Fabr.

A small horntail conspicuous because of its blue abdomen and rufous legs attacks spruce and fir.

This horntail is even rarer than the preceding and may be recognized by its unicolorous antennae, the triangular apical horn of the female in connection with its blue abdomen and the rufous legs. Its habits are probably similar to those of the foregoing species, and it has likewise been recorded as working in spruce and fir.

Tetropium cinnamopterum Kirby

A somewhat cylindric black or brownish beetle about ½ inch long occurs in July on spruce.

It may be recognized by its jet-black head and thorax, which latter is nearly cylindric, though swollen at the middle, and by the dull brown wing covers. This borer, according to Dr Hopkins, infests the green bark and wood of injured and dying spruce trees in West Virginia. He states that it is very injurious, since it hastens the death of the trees and causes rapid decay of the wood. Adults were taken by him in March and July.



Fig. 126 Tetropium cinnamopterum, enlarged (original)

Phymatodes dimidiatus Kirby

A black, red-shouldered, flattened beetle about ½ inch in length, occurs on spruce.

Examples of this species were taken on spruce at Big Moose N. Y., July 7, 1903.

Description. The head, thorax and posterior portion of wing covers black; anterior portion of latter and legs brownish. The antennae are slender, about as long as the body, thorax subpyriform, swollen anteriorly; sides nearly parallel, femora clubbed. This species may be distinguished from its allies, according to Wickham, by the absence of narrow cross-

bands on the dark elytra, which are of a lighter shade before the middle.

Life history and habits. The beetles have been met with in West Virginia the latter part of June, by Dr Hopkins, who records this species as a borer in spruce bark. Mr Young has known of this insect emerging from spruce siding after it had been manufactured, and Dr Hamilton lists it as occasional in southwestern Pennsylvania, stating that the larva is probably imported in lumber.

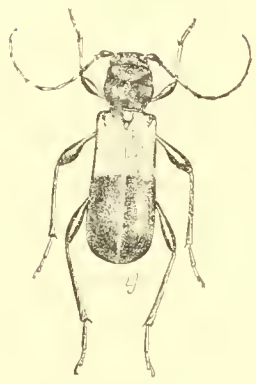


Fig. 147 Phymatodes dimidiatus, enlarged (original)

Distribution. This insect is probably widely distributed in the northeastern United States, since it has been recorded from West Virginia, New Jersey, Staten Island and Buffalo N. Y., besides being occasionally found in southwestern Pennsylvania.

Canadian Leptura

Leptura canadensis Fabr.

A large, handsome, black beetle with the basal portion of the black wing cases deep red and the middle antennal joints broadly ringed with reddish, works as a footless grub under spruce and hemlock bark.

This species is more or less common in hemlock, and according to Dr Hopkins, the stout, fleshy, round-headed grubs mine the sapwood of dead spruce and hemlock, inducing rapid decay. We have met with what we believe to be this larva working in live hemlock tissues, though this habit may be somewhat exceptional. The adult beetle is a handsome insect about ¾ inch in length, deep black, with the surface coarsely and densely punctured. It may be readily distinguished from its allies by the deep red basal portions of the wing covers and also by the antennae being broadly ringed with paler red, the joints of the middle being alternately red and black. The beetle may be met with in July and is rather common in the Adirondack region.

Xylotrechus undulatus Say.

A beautiful, cylindric, brownish beetle about ½ inch long, and ornamented by sulfur-yellow markings, occurs on both hemlock and spruce.

This species is closely allied to X. colonus Fabr., but may be separated, according to Mr Wickham, by the thorax having an apical and basal pubescent band, the elytral bands being angulated or undulatory. It is a beautifully marked species with considerable sulfur-yellow on the lateral anterior portions of the thorax. Specimens were taken on spruce and hemlock at Lake Clear and Big Moose in early July 1903. Dr Packard also states that he has beaten it from spruce at the end of July, and Dr Lintner states that Erastus Corning jr of Albany, met with the insect at Murray Bay Can., in the month of August, at which time they were emerging from burrows in spruces.



Fig. 138 Xylotrechus undulatus, enlarged (original)

Distribution. This species has a wide distribution in this country, since it has been recorded from Canada and the Eastern States, and Dr Packard mentions having received it from Tacoma Wash. Mr Fall records it from the northern portion of California. This species is stated by Dr Hamilton to be rare in southwestern Pennsylvania. It has been recorded from New Jersey by Dr Smith.

Blazed tree borer

Serropalpus barbatus Schall.

A slender, whitish, wood-boring grub enters the wounds of living trees and bores deep into the sapwood and heartwood.

The larva of this Melandryid is a slender, whitish, wood-boring grub, which enters wounds on living trees and bores deep into the sapwood and heartwood, causing rapid decay of the infested parts. Dr Hopkins states that it is common in blazed wood on balsam, fir and spruce trees along trails in northwestern Maine, while Dr Smith lists it from New Jersey and states that it has been taken from dry fungus.

Mordella borealis Lec.

A small, narrow, triangular beetle about 3/16 inch in length, irregularly marked with silvery white, occurs on spruce and decaying maple.



Fig. 199 Mordella borealis, enlarged (original)

This species may be recognized, according to Dr Smith, by the short, truncate anal style, its dull black color, with the thorax, pygidium and the elytra sprinkled with small, rounded spots of silvery pubescence; wing covers with a narrow, interrupted band, composed of confluent spots behind the middle.

This species was taken on dying or recently killed spruce at Big Moose N. Y., July 2, 1903, by Mr Young, and he has also found it breeding in decaying maple stumps. This is essentially a northern species, and has been recorded by Dr LeConte, from the Northern States. It is also listed from the vicinity of Cincinnati by Dury.

Dryocoetes autographus Ratz.

A small, stout, nearly cylindric, brownish bark beetle about 1/8 inch in length, may be met with in spruce bark.

This borer was taken in considerable numbers under spruce bark at Big Moose N. Y., July 2, 1903. It may be distinguished, according to Dr LeConte, from its allies, by its larger size and the smooth front of the strongly punctured prothorax. He records this species from Alaska, Canada and Virginia under pine bark, while Dr Hopkins states that it occurs under green bark of logs and stumps of spruce. It is possible that there is a mistake in the preceding record. This species evidently has a wide distribution in the northern part of this country, since it has been recorded from Alaska, Hudson Bay Territory, Canada, Lake Superior, Mount Washington N. H., New Jersey, southwestern Pennsylvania, Virginia and West Virginia. The peculiar structure of the proventriculus is illustrated on plate 69, figure 9, and that of the tibia in figure 118, page 469.

Dryocoetes sp.

A species belonging to this genus was met with by the writer Aug. 14, 1900, at Saranac Inn, where it was breeding under spruce bark in company with the spruce bark borer, Polygraphus rufipennis Kirby. The beetle is about 3/32 inch long, and in the case of the specimen obtained, of a yellowish brown color. It is doubtless much darker in mature individuals and its galleries are larger than those of Polygraphus.

Cryphalus striatulus Mann.

A small, yellowish brown to almost black bark beetle occurs in spruce bark, working particularly at the base of limbs.

This species was taken by us, working in spruce bark in association with Tomicus balsameus Lec. The affected tree was near water and was noticeable because of its red foliage. The trunk was not injured though this borer was working in some numbers at the base of the limbs and appeared to be the primary cause of the trouble. This species was taken in August, working at the base of a small hemlock limb, the foliage of which had begun to turn brown. It was also observed at work in a small balsam tree, which had been cut several months.



Fig. 20. Middle tibiae. *a* Cryphalus striatulus; *b*—Pityophthorus minutissimus; *c*—P. puberulus; *d* Phloeotribus frontalis (original)

The adult is a light yellowish brown to almost black beetle about 3/32 inch long. The prothorax bears a number of prominent chitinous tubercles and the wing covers are faintly striated with rows of fine punctures. The galleries of this species are very irregular and appear to have no plan, consisting, as they do, of a series of interlacing burrows, which often unite to form large excavations around the base of a twig.

Spruce wood engraver

Pityophthorus carinicceps Lec.

A minute, black or brown beetle excavates many short, radiating, curved galleries in young dying red and black spruce.

This minute form excavates many short, radiating, curved galleries from a large central chamber, working in the bark and surface of the wood of twigs and branches of dying trees and stems of young, dying red and black spruce. This species ranges from western Maine to Morgantown W. Va., and westward to Detroit Mich., according to Dr Hopkins. Like its allies, it is of comparatively little importance because its attacks are confined to dying or dead trees, mostly limbs.

Buprestis maculiventris Say.

A large, metallic, flattened, oval beetle about $^3/_4$ inch long, occurs on balsam in July.

This species was taken on balsam at Lake Placid, July 10, 1903.

Description. It is a brassy-brown beetle about $^3/_4$ inch in length, and is easily distinguished, according to Mr Harrington, by the reddish yellow ventral spots on each side of the abdominal segments, and by smaller spots of the same color on the anterior lateral margin of the thorax. The prothorax is rather coarsely, irregularly punctured and the wing covers deeply striated (according to Harrington frequently rumpled), tips almost truncate.

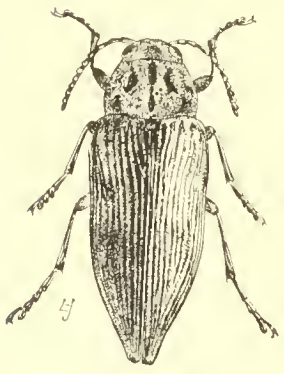


Fig. 20: Buprestis maculiventris, enlarged (original)

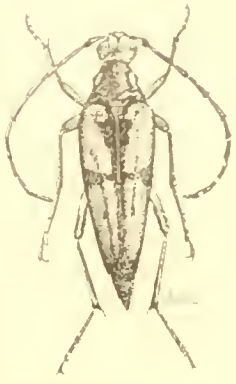
Life history. Mr. Harrington states that this species is common on both old and young spruce trees in June and July, and adds that he has had the beetles emerge from pine timbers about the end of June.

Distribution. Dr LeConte states that this species occurs in Pennsylvania, Lake Superior and Newfoundland.

Leptura subhamata Rand.

A rather slender, somewhat triangular beetle with a subtriangular spot near the middle of the outer margin of each wing cover, occurs on hemlock.

This beautiful insect may be easily recognized by its yellowish elytra with a subtriangular spot near the middle of the outer margin. It was taken on tamarack at Lake Clear Junction July 8, 1903. The trees had been killed by a fire, and this species was evidently about to oviposit on them. This beetle has been taken by Mr Harrington on oak and also from a beech log.



This form was described from the White mountains, and has been recorded from New Jersey, by Dr Smith, on the authority of Mr Leng. It is also listed by Mr Ulke, from the District of Columbia, and six examples were taken by Dr John Hamilton, in southwestern Pennsylvania. This, in connection with its occurrence in New York State, leads us to believe that it is somewhat generally distributed in the northeastern United States and probably ranges into Canada.

Cedar tree borer

Hylotrupes ligneus Fabr.

A brownish beetle from ⅜ to nearly ½ inch long, with two large, blue patches at the base of the wing, bores in the larval stage in cedar.

This species is common in northwestern Maine, according to Dr Hopkins, who states that its slender, whitish bark and woodboring grub excavates winding burrows in the bark and surface of the wood of living arbor-vitae, causing the death of trees and serious defects in the wood. Mr Fall states that this species is common in southern California, where it depredates on pine, and that a nearly black variety occurs only on fir wood piles situated in more or less shady forests. He states that the typical form of this species may be taken on pine and spruce wood piles in sunny

situations. This beetle may be recognized by its brown head, antennae, prothorax and legs, while the wing covers are mostly a dark prussian blue with a broad, yellowish band near the apical third, extending anteriorly along the margin and to the base of the wing covers along the suture. This insect ranges from about 3/8 to nearly ½ inch long.

False pine webworm

Lyda sp.

Loose web nests thickly sprinkled with excrement, occur on the terminal twigs and contain greenish or brownish false caterpillars.

Several species of these interesting false caterpillars feed on both hard and soft white pine. They are easily recognized by the conspicuous antennae and almost equally developed anal filaments at the opposite extremity which, with the prominent anal shield, give the creatures a somewhat two-headed appearance. While the nests of these sawfly larvae are somewhat common, the insects are rarely abundant enough to cause serious damage. Their method of feeding is somewhat different from that of Benta, in that there is more of a tendency to eat the needles off at a uniform level. A soldier bug, Euschistus variolarius Beauv., is rather common on the nests of these insects in September and is probably of considerable service in keeping these leaf feeders in check.

Pine webworm

Benta malanogrammos Zell.

Loose web nests, with considerable brown excrement, on the needles of terminal pine twigs, are very characteristic of this species.

This leaf feeder appears to be a somewhat common one on pine in the vicinity of Albany, but as it is a difficult insect to rear, it has been impossible to determine its specific identity beyond question. The peculiar nests, found in midsummer and later, are two to three inches long and consist of an irregular, loose, cobwebby structure with brown pellets of excrement thicklv sprinkled throughout the mass. This species has been

observed by Professor Comstock in Florida, and he states that the larvae on attaining maturity, enter the ground for pupation.

The parent moth has a wing spread of about an inch with the fore wings dark brown, nearly black on the basal third and beyond there is a broad, light gray band crossing the wings, outside of which is a dark brown area followed by gray. The hind wings are a dark ashy color with a silky luster.

The full grown larva is about $\frac{3}{4}$ inch long, dark yellowish brown, paler beneath and with a moderately distinct subdorsal line extending from the thoracic shield to the posterior extremity. Head, thoracic shield and last abdominal segment yellowish brown, more or less irregularly marked with dark brown or black.

This species has not, to our knowledge, caused any serious injury and it is hardly probable that it will ever become dangerous. One of the soldier bugs, Euschistus variolarius Beauv. is common in the fall on web nests of Lyda and doubtless preys on this species also.

Imperial moth

Basilona imperialis Drury

A large, thick, pale green caterpillar 3 to 4 inches long, with pale orange head and legs and six spined, yellow tubercles behind the head, occurs on white pine needles late in August and through September.

This, one of the largest native caterpillars, is most common in New York State on white pine though it lives on a considerable variety of food plants and in the South it is said to have a marked preference for species of oak.

Description. The male of this magnificent moth has a wing spread of 4 inches and that of the female exceeds $5\frac{1}{2}$ inches. The insects are light yellow, spotted and banded with brownish as represented on plate 41, figure 1.

The summarized descriptions of the early larval stages are drawn from Dr Lintner's more extended account. The recently hatched larva is

dull red, $^1_4$ inch long, each segment except the last two with six rows of bristle-tipped spines, annulate with three fuscous bands. True legs black. After the first molt the head is a shining red and the segments reddish in the middle shading into an obscure color at the incisures. The spines are glossy black with branches bearing apical white bristles. The two long spines of the second and third segments and the mesal one of the 11th about one fifth the length of the body, directed slightly forward and unequally forked. After the second molt the larva is $^5_{10}$ inch long, the head dull red with fuscous mesally and laterally. The body is an umber brown, lighter at the incisures, gray dorsally and with a dark vascular line. Spines of second, third and eleventh segments curved, glossy black with yellowish base. The caterpillar after the third molt may be recognized by the long white hairs arising from the central portions of the segments, the dorsal ones being nearly twice the length of the thoracic spines, the lateral ones shorter. These spines are honey-yellow studded with conical projections and each bearing a short, acute, fuscous spinule. After the fourth molt the larva is 1^3_4 inches long and the heretofore cylindric spines are conic and armed with stout spinules, anal plates with conspicuous whitish granulations.

The nearly full grown larva is 3 to 4 inches long, green with a reddish tinge on the back. The yellowish black marked head and anal shield, the conspicuous spined yellowish tubercles and the prominent light spiracles with their darker margins are all conspicuous features. This larva can easily be recognized by reference to plate 19, figure 1.

The pupa is dark mahogany brown, 1 to 1^1_2 inches long and subcylindric in form.

Life history. The moths fly in June and deposit eggs, producing caterpillars which attain maturity in September, at which time they forsake the trees and construct cells in the ground and change to pupae, in which condition the winter is passed.

This caterpillar has a wide range of food plants. It has been recorded from 52 species representing 15 natural orders. The white pine appears to

be the favorite in the North and a number of species of oak in the South. It has been stated that in the vicinity of Germantown Pa., the larvae of this species have displayed a marked preference for red maple foliage in recent years.

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Harris's pine hawk moth

Lapara bombycoïdes Walk.

A grass-green, yellow and white striped caterpillar feeds on pine in the middle of September, the moths appearing the following June.

This caterpillar is interesting largely because of its peculiar appearance, its striking color rendering it inconspicuous on pine needles. The young larva is remarkable because of its large, high head terminating in a conspicuous cone. Just before the last molt the head is triangular, conical, the body thick and stout. It is then green with yellowish and red stripes.

The full grown larva is green like that of the pine leaves, and has the broad, brick-red dorsal stripe wanting on the prothoracic segments and represented by patches on the two following. This band is bordered with a whitish yellow line. There is a lateral straw yellow line and a broad white line becoming yellow anteriorly, below the spiracles. This larva may be easily recognized by its conspicuous striping.

White pine tufted caterpillar

Panthea furcilla Pack.

A dull red caterpillar banded with brighter red, with a light lateral line and reddish hairs in clusters, occurs on pine during late August and in September.

This species is not common. The larva, when full grown, measures about 1 5/8 inches in length. It has been described by Dr Packard as follows :

The body is black, with sparse, dull, light yellow hairs radiating from dark or pale mamillae. A pair of long prothoracic straight tufts projecting

over the head, and a pair of long similar erect ones on the eighth segment. All the legs are reddish. Some of the full grown larvae turn black. The moth appears the following June.

Larch lappet

Tolype laricis Fitch

A dull, rusty brown, irregularly white-spotted flattened caterpillar with series of grayish tufts on each side, harmonizes very closely with pine bark.

This caterpillar feeds on pine, hemlock, and larch and occurs on plum and cherry. It is rarely abundant enough to cause any injury and its claim to notice in this connection is based on its being a most excellent example of protective mimicry. This latter is due to several causes. In the first place it is a dull, rusty brown color, broken by irregular, white markings, which give it a striking resemblance to the bark of a tree. This protective feature is further hightened by the flattened form of the caterpillar and especially by the grayish tufts of hair springing from the large lateral tubercles and extending on either side a distance nearly equal to the width of the caterpillar itself. This curious larva when at rest harmonizes so closely with its surroundings as to render its detection exceedingly difficult. This latter was nicely exemplified by an experience of the late Dr Lintner, who showed an entomologic friend (well known because of his keen sight further sharpened by long experience in collecting, so that few caterpillars could escape his eyes) a small twig on which were four of these caterpillars, and though they were within reach of his extended finger, he was unable to discover them until their presence was revealed by movements as one after the other was touched. The cocoons of this interesting species are equally difficult to detect. They are placed longitudinally in a slight angle or depression and so spun as to harmonize very closely with their surroundings, even to the extent of light markings of the bark being continued on the cocoon.

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Pine leaf miner

Paralechia pinifoliella Chamb.

A small cylindric larva mines the leaves of various species of pine.

This small leaf miner is common on hard pine at Karner and the same is undoubtedly true in other sections of the State where this tree occurs. The tip of the leaf and in many instances the larger portion above its base is mined, dies and turns brown [pl. 20, fig. 5].

Description. The moth is very small, brownish, irregularly gray banded with a wing spread of 3/8 inch, and may be recognized by reference to plate 20, figure 23. The egg has been described as reddish brown, globular, about .14 mm in diameter. The larva is 1/6 inch long, yellowish brown with the head, thoracic shield and anal plate dark brown.

Life history. A single needle apparently affords ample sustenance for the development of the larva, which enters near the middle of the leaf and burrows toward the end, and then, reversing its course, proceeds toward the base. The borings are pushed out at the point of entrance. Professor Comstock states that there are certainly two and possibly three generations annually.

Natural enemies. This leaf miner is subject to attack by a number of parasites, notably several minute Chalcids and a small Tachina fly.

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Pine tube builder

Eulia politana Haw.

Peculiar tubes of webbed-together pine needles occur in midsummer and in September on white and probably other pines.

This insect is rarely abundant and is worthy of notice largely because of the peculiar tubes it constructs among the pine needles. These consist of about 15 needles, which are bound together by silken threads, and the

terminal third eaten off. Dr Packard states that there appears to be two broods, full grown larvae having been observed by him the latter part of September, in tubes from which the terminal portions of the needles were not eaten. He was of the opinion that this was prevented by the approach of cold weather. The typical short tubes are found in midsummer.

Description. The maker of these tubes is a pale green larva about $^1/_3$ inch long. The head is a light brown color with darker, somewhat reddish patches on each side. It is very active, escaping from the tube and dropping by a thread when disturbed. The pupa is found inclosed in a slight web within the tube.

The head, thorax and fore wings of the parent insect are a dull rust-red color, the latter with two oblique paler bands; one a little before the middle and the other beyond parallel to it, crossing the wings. The hind wings and the upper side of the abdomen are silky gray. Wing spread half an inch.

This is a widely distributed form, as Dr Dyar has listed it from Europe and the north Atlantic States.

Light-loving grapevine beetle

Anomala lucicola Fabr.

A short, stout beetle from $^1/_3$ to nearly $^1/_2$ inch long, is abundant on hard pine foliage the latter part of June and throughout July.

This beetle [pl. 20, fig. 12, 13, 14] is more commonly known as a grape feeder, though its presence in large numbers on hard pines would also indicate that it is able to subsist on the pine. Its presence may be merely incidental, as soil conditions at Karner N. Y. are unusually favorable for the larvae.

Metachroma marginalis Crotch

A light brown beetle less than $^1/_3$ inch long is rather common on hard pine in midsummer.

This light brown beetle occurs rather commonly on hard pine from the latter part of June till the last of August. It does not appear to be

injurious to the tree, though usually taken at the base of the needles. This species probably has an extensive range, as it has been recorded from North Carolina and Kansas. The larva are probably root feeders.



Spruce sawfly

Pteronus integer Say

Pale green, false caterpillars feed singly on spruce the latter part of the summer.

This species is stated by Dr Packard to be common over the Northern States and may at times prove obnoxious. It occurs on spruce in Maine during the latter part of the summer and feeds singly, not being gregarious as in the case of many species. He states that possibly the fly appears in the fall, though probably it winters in the cocoon and may be found abroad in the early part of June. The larva and its cocoon have been described by Dr Packard as follows[1]:

Larva. The body is long, broader than the head; pale pea green; of the color of the leaves of the spruce among which it feeds. The head is smooth, of the same color as the body, with a dark patch extending upward behind each eye. Body not spotted, but with a dorsal dark green stripe, bordered on each side with whitish glaucous green. Along the body is a lateral conspicuous broad white stripe, the stripe much scalloped below. Body beneath and abdominal legs uniformly green; thoracic legs pale honey yellow, except at base. Length 17 mm.

Cocoon. Of the usual oval cylindrical form; of a pale horn color, of the usual density, the walls being opaque. Length 13 mm; diameter 4 mm.

The adult sawfly is about $\frac{1}{4}$ inch long, yellow with black or dark brown markings, except on the sides and venter of the abdomen, which are a greenish tinge.

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[1] Possibly the larva of another species. Dyar records Pteronus integer Say as an oak feeder. N. Y. Ent. Soc. Jour. 1898. 6:122.

Spruce cone worm

Dioryctria reniculella Grote

A red-headed, brownish caterpillar about 5/8 inch long, feeds on young fresh spruce cones, surrounding them with a mass of webbed excreta.

This species was brought to our attention by the receipt of a large number of infested cones collected in the Adirondacks. The attack, according to Dr Packard, is usually confined to the young cones, into which the larvae bore and mine in different directions, excavating galleries in the interior and separating the scales from the axis of the cone. The caterpillar may mine one cone and then pass into an adjoining one, spinning a rude silken passage between the two. Occasionally a bunch of three or four cones is tied together with silken threads, in which latter masses of castings or excrement become entangled.

Description. The larva has been described by Dr Packard as follows:

Head and prothoracic shield deep amber brown; the body reddish carneous or amber brown, with a livid hue; a faint, dark dorsal, and a broader, subdorsal line; piliferous warts distinct; each segment divided into a longer anterior and shorter, narrower, posterior section, bearing two dorsal piliferous warts, besides a lateral one.

Length 5/16 inch.

The parent insect has its fore wings ornamented with light and dark gray. There is a broad basal light patch and before the middle of the wing a white zigzag line and near the outer margin another white zigzag line with a dark border. Wing expanse about 3/4 inch.

This is considered by Ragonot to be a synonym of the closely allied D. decuriella Hübn., a form which feeds both on firs and pines, and it is possible that the species under description has similar food habits. There is no practical method of preventing its depredations, were it desirable, other than collecting and burning the infested cones before their inhabitants have escaped.

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Balsam gall midge

Cecidomyia balsamicola Lintn.

A small midge produces an oval enlargement near the base of balsam needles.

This insect was first brought to the late Dr Lintner's attention in 1886, because of its abundance on balsam fir in Adirondack localities. It does not appear to occur in the vicinity of Albany, though it has been taken at Shelbourne N. H., and specimens of what appears to be the same insect, were received by Dr Lintner from North Carolina, where they infested the southern balsam, Abies fraseri. Occasionally this insect is so abundant as to give a peculiar nodose appearance to affected trees, at which times as many as three quarters of all the leaves may be infested. The larvae are inactive, hardly move and show no disposition to feed. Badly infested trees lose a considerable portion of their foliage in December, all the galls dropping. The adult has not been reared so far as known.

False chinch bug

Nysius angustatus Uhler

A small, grayish and brown plant bug $^{3}/_{16}$ inch long occurs on a variety of plants.

This species is best known on account of its being confused with that notorious enemy of the farmer, the chinch bug, Blissus leucopterus Say. It is a general feeder, occurring on such diverse plants as appletrees, hard pines, grapevines, potato vines, turnips and radishes.



Fig. 204 Phytocoris eximius, enlarged (original)

Phytocoris eximius Reut.

This is an inconspicuous, brownish marked Capsid (fig. 204), a little less than $^{1}/_{4}$ of an inch long. It occurred somewhat sparingly on hard pine at Karner in September, 1901.

Pilophorus crassipes Uhl.

This small, brown plant bug [pl. 20, fig. 15], only about $^1/_4$ inch long, occurs rather commonly on hard pine in midsummer.



Fig. 205 Oliarus 5-lineatus, enlarged (original)

Oliarus quinquelineatus Say

This brownish, membraneous winged plant bug a little over $^1/_4$ inch in length occurred in midsummer on hard pine. It was taken in 1901 at Karner as follows: July 8, two; July 19, two; July 27, one and Aug. 8, one.

Spittle insects

Masses of frothlike spittle on pines indicate the presence beneath of small stout, triangular or rounded bugs.

Several of these interesting forms are briefly noticed below.

Saratoga spittle insect, Aphrophora saratogensis Fitch. This spittle insect may be recognized by its uniform brownish color variegated with very light brown or yellow. It is about $^3/_8$ inch long and more slender than A. parallela Say. Adults occur from the latter part of June to the last of September.

Parallel spittle insect, Aphrophora parallela Say. This spittle insect is somewhat common on hard pine at Karner, adults occurring during July. It is about $^1/_2$ inch long and may be easily recognized by the whitish spot in the center of each wing cover and by the smooth, whitish line along the dorsum of the head and prothorax [pl. 20, fig. 22].

Quadrangular spittle insect, Aphrophora quadrangularis Say. This small, rather prettily oblique-banded spittle insect $^1/_4$ inch long, occurs in small numbers on hard pine in August and September.

Pine clastoptera, Clastoptera pini Fitch. This species, described by Dr Fitch, is a stout, oval, blackish tree hopper $^1/_6$ inch long. Head pale yellow, margined anteriorly with black; thorax sculptured transversely and ornamented with a pale yellow anterior band. Wing covers with

a broad, clear, white margin outwardly, broken by black behind the middle and with a shining black dot near the tip. Legs and ventral surface yellow.

The young of this little species occur on pines about June 1, in this State. They are enveloped in frothy masses among the terminals, and about this time they are $\frac{1}{4}$ inch in length, and have a small shiny black head and thorax, with the body broad, flattened, and flesh color, or sometimes brick-red, as described by Miss Wolsey, of Matteawan.



Fig. — Clastoptera obtusa, enlarged (original)

Obtuse clastoptera, Clastoptera obtusa Say. This little spittle insect occurred in small numbers on hard pine at Karner, the young being located at the base of leaf petioles. Adults were taken from June 13 to 19. They are from $\frac{1}{8}$ to $\frac{3}{16}$ inches long and irregularly marked with brown, yellowish brown and yellowish white. It is remarkable for its obtuse form.

Stictocephala inermis Fabr.

A greenish brown leaf hopper about $\frac{1}{4}$ inch long, occurs on hard pine in midsummer.

This species has somewhat the shape of a beechnut and is not marked by any excessively developed processes. It was present in small numbers on hard pine during July 1901. This tree hopper probably has a wide distribution as it has been recorded from a number of eastern and several western States.

Dichrooscytus rufipennis Fall.

A small, active, rather slender plant bug about $\frac{1}{4}$ inch long with yellowish head and prothorax and yellowish red wing covers occurs on hard pine in midsummer.

This is a small, active, rather slender plant bug, measuring about $\frac{1}{4}$ inch in length. The head and prothorax are yellowish and the yellowish red wing covers are bordered by the same. This species was met with by the writer in small numbers on hard pine at Karner in 1901. It is quite agile and but few specimens were captured, the numbers and dates being as follows: one on June 13, two on the 26th and two July 8. The species has been listed from New Jersey by Dr Smith and Douglas & Scott[1]

[1] 1865 British Hemiptera, p. 478

record the beating of specimens from Pinus sylvestris in several English localities.

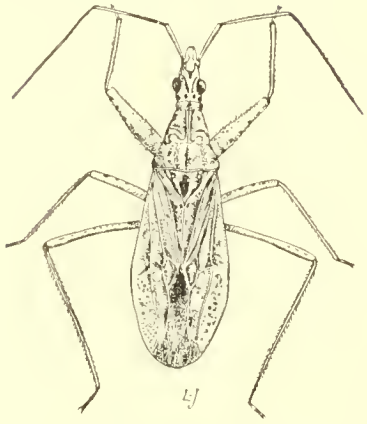


Fig. 207 Nabis rufusculus, enlarged (original)

Nabis rufusculus Reut.

A light brown, slender plant bug about ¼ inch long with the thorax variously marked with red, pinkish and light brown occurs on hard pine.

This slender plant bug ¼ inch long occurred in small numbers on hard pine at Karner in 1901. It is slender, widening gradually to the posterior third of the wing covers. The black eyes and the brilliant carmine ocelli are conspicuous. The thorax is variously marked with red, pinkish and light brown and the wing covers have a pinkish shade mottled with light brown, the membrane fuscous. It undoubtedly preys on various species frequenting pines and other trees.

Gypona octolineata Say

A grayish, yellowish or red-marked elliptic insect about ½ inch long, occurs the latter part of summer on hard pine, many shrubs and plants.

Specimens of this insect were taken on hard pine at Karner, Sep. 18, 1901. This variable form presents marked differences; some individuals have eight reddish or rosy lines, while others have yellowish lines on the thorax, and with the wing veins and margins similarly ornamented. It has a wide distribution, having been recorded from Colorado, Missouri and several localities in New Jersey.

Eutettix strobi Fitch is common on pines in May.

Bramble flea louse

Trioza tripunctata Fitch

A small, reddish brown, jumping plant louse ⅛ inch long, abounds on hard pine the latter part of the season and in early spring.

This species is very abundant on hard pines at Karner and its presence on these trees has also been recorded from Canada and Florida. It occurs

on blackberry, which may prove to be its normal food plant. The following paragraph is a summary of Mr Sirrine's biological account of this insect:

Life history. Last stage nymphs were taken Sep. 12 on blackberry and the first adults were seen Sep. 29 and by Oct. 15 all had transformed. The light yellow eggs are deposited in June and July on blackberry, maturity being attained in September or October, the adults hibernating in sheltered places.



Fig. 248 Erythroneura tricincta, enlarged (Orig.)

Description. The perfect insect is about 1/8 inch long with the wings deeply tinged with brown along the veins and the entire body a yellowish brown color except the darker eyes. The young are nearly pure white, ranging to a greenish white and when seen by the unaided eye, resemble leaf mites or the young of spiders more than plant lice.

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Woolly pine scale

Pseudophilippia quaintancii Ckll.

A conspicuous snow-white, woolly scale is sometimes very abundant on the more tender growths of pitch and southern yellow pine [pl. 51, fig. 3].

Examples of what are presumably this species were received from Orange county, New York, and Pike Pa., where the insect was extremely abundant on thousands of young pitch pine. It may be at once recognized by the thick woolly masses at the base of the pine needles, the woolly covering being conspicuous and easily detected at some distance. This scale is known to the natives as "bleeding pitch" and "pitch pine wool." The twigs turn brown and become brittle soon after the scales drop off. The attack was confined largely to trees less than 14 feet in hight. The pest was not observed on white pine, hemlock, spruce or larch in the infested region. This species was found in 1897 by Prof. A. L. Quaintance at Lake

City Fla., where it was very abundant and generally distributed on branches and young trees of Pinus australis. He states that the insects secrete an abundance of honeydew in which a black fungus develops.

Hemlock scale

Aspidiotus abietis Schr.

An oval, dark gray, often blackish scale with a lighter margin and sometimes with a bluish, brownish or purple tinge, occurs on hemlock, pine, fir and maple foliage.

This species is reported by Professor Comstock as being rather common on the lower surface of hemlock leaves at Ithaca, and has been found by us in small numbers on hard pine leaves at Karner. It is an European species, which has been reported in this country from Maine, Massachusetts, New York, New Jersey and Georgia. The female scale has been described by Professor Comstock as follows:

The scale of the female is rather elongated, with its sides parallel and ends rounded. The exuviae are nearly central, and are covered with secretion. The color of the scale is dark gray, often approaching black, with the margin lighter, and sometimes with a bluish, brownish, or purplish tinge. In many specimens of the fully formed scale, the part covering the exuviae is more or less distinct, appearing like a small scale with a light margin superimposed upon a larger scale. Length .08 to .12 inches.



Fig. 89 Lebia grandis, much enlarged (Original)

Lebia grandis Hentz

This brilliantly marked ground beetle about ⅜ inch in length may be recognized by its brick-red head and thorax and bluish, deeply striated wing covers.

It is well known as an enemy of the potato beetle, and was taken in small numbers on hard pine at Karner in 1901, one specimen being captured Sep. 18. It probably preys on some of the more defenseless forms infesting these trees.

Nine-spotted lady beetle

Coccinella novemnotata Herbst.

A hemispheric, yellowish, nine-spotted beetle.

This little lady beetle is one of our more common species and is somewhat abundant on hard pines at Karner from July to September. The insect is a well known species and may be easily recognized by the accompanying illustration. It appears to be one of the more effective species in controlling plant lice, since it is quite commonly met with on trees infested by these little insects, and is probably an efficient check on those living on pine.



Fig. 30 Coccinella [illegible], enlarged (original)

This species has been recorded by Mr Crotch from the Atlantic region, Mexico and Guatemala.

Three-banded lady beetle

Coccinella trifasciata Linn.

A yellowish, almost black-banded, hemispheric beetle.



Fig. 31 Coccinella trifasciata, enlarged (original)

This medium to small sized lady beetle is sometimes rather abundant. It is easily recognized by the transverse black spots, which give it the appearance of being three-banded, hence its specific name. This little insect was met with in small numbers on hard pine at Karner, one being taken Aug. 9 and two Sep. 6, 1901. It undoubtedly preys on the plant lice infesting this tree. This beetle has a very wide distribution, having been recorded by Mr Crotch from Lake Superior, Oregon, Siberia and Lapland.

Ips sanguinolentus Oliv.

A black beetle about $\frac{1}{4}$ inch long with a conspicuous orange band containing two circular black spots on the basal two thirds of the wing covers.

This species has a general resemblance to Ips quadriguttatus Fabr., and possesses similar habits. It measures about $\frac{1}{4}$ inch in length,



Fig. 212 Ips sanguinolentus, enlarged (original)

and may be recognized by the large reddish orange markings on each wing cover in the center of which is a jet-black, nearly circular spot.

Ips quadriguttatus Fabr.

A shining black beetle about ¼ inch long with four irregular, orange markings on the wing covers.

This shining black beetle with four irregular orange markings on the wing covers, is from 3/16 to 5/16 inch long and occurs in the galleries of various wood borers, particularly those moist with exuding sap. It feeds on decaying fruit, corn on the ear, seed after it has been planted and has been taken in the fall on oak and hard pine at Karner.



Fig. 213 Ips quadriguttatus, enlarged (original)

Corymbites propola Lec.

A small, snapping beetle less than ⅜ inch long with a light head and light yellowish elytra marked with dark brown.

This little snapping beetle is less than ⅜ inch in length and may be recognized by its light head and the light yellowish elytra marked with dark brown. This species was met with in small numbers on hard pine at Karner, one specimen being taken June 4 and two June 13, 1901. It has been recorded from Lake Superior, Eagle Harbor, and is also found in western New York as stated by Dr LeConte.

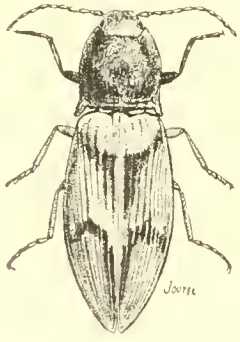


Fig. 214 Corymbites hieroglyphicus, enlarged (original)

Corymbites hieroglyphicus Say

A small, snapping beetle about ½ inch long with its yellowish wing covers marked with curved, dark brown or black lines.

This peculiar snapping beetle, about ½ inch long with dark brown head and thorax and yellowish wing covers marked with curved, dark brown or black lines, occurs on hard

pines in June and July. This somewhat rare species has been recorded from Massachusetts, New Hampshire, New Jersey and Pennsylvania and Dr LeConte gives its distribution as Lake Superior, Ohio and Maine and states that it is not rare.

Cloudy bark beetle destroyer

Thanasimus nubilus Kl.

A small, black clerid with wing covers marked with zigzag black and gray transverse bands occurs on spruce.

The adults of this beneficial clerid feed on the spruce destroying bark beetle, Dendroctonus piceaperda Hopk., and associated species. The larvae of this predaceous form prey on the young and pupae of bark beetles in their galleries. This very beneficial species resembles an ant in appearance. It may be recognized by its black head, by the middle portion of the body being red and the wing covers marked with zigzag black and gray transverse bands.

Hydnocera pallipennis Say

A small beetle 3/16 inch long with pale yellow, irregularly mottled wing covers and black head and thorax.

This is a small beetle about 3/16 inch in length. It has a black head and thorax, and the wing covers are a pale yellow and irregularly mottled with brown. A single specimen was taken July 19, 1901, on hard pine at Karner. It has been recorded by Dr Smith as generally distributed and not rare in New Jersey.

Hydnocera humeralis Say, var. cyanescens Lec.

A jet-black, slender beetle nearly 3/16 inch in length, may be taken on low shrub growths in midsummer.

Examples of this species were taken on hard pine at Karner July 2, 1902.

Description. This beetle is about 3/16 inch in length, black in color, except that the head and thorax have dark grayish reflections in certain lights. Eyes large, prominent; thorax broader than long, subcylindric, with

lateral, rounded tuberosities. Wing covers rather coarsely, irregularly punctured, rounded at the apex and diverging.

Habits and distribution. This predaceous species appears to be common in midsummer on late shrubs, and is probably generally distributed in the northeastern United States, having been recorded from the vicinity of Buffalo N. Y., southwestern Pennsylvania, various localities in New Jersey and the District of Columbia.

Ernobius mollis Linn.

A small, variable, somewhat elongated, brown beetle about $\frac{1}{8}$ inch long occurs on hard pines in June and July.

This common European species introduced about 1865, is a common form on hard pines in midsummer. It is recorded as generally distributed in New Jersey though not common. Its allies, E. granulatus Lec. and E. luteipennis Lec. have been taken on pines in New Jersey.

Dichelonycha albicollis Burm.

A greenish, coppery, elongate, parallel-sided beetle about $\frac{1}{2}$ inch in length, occurs rather sparsely on hard pine in midsummer.



Fig 215 Dichelonycha albicollis, enlarged (original)

This species was taken in midsummer in rather small numbers at Karner, where it occurred at the base of hard pine needles. Specimens were captured at intervals throughout June and early July 1901, and also the following season. Dr Fitch[1] states that it becomes quite common on pines about the middle of May, eating the foliage and continuing for about a month. Its distribution has been given by Dr Horn as the Middle States and Canada, and it has been recorded from several localities in New Jersey by Dr Smith.

[1] 1858 Fitch, Asa. Ins. N. Y. 4th Rep't, p. 61.

Pine chrysomela

Glyptoscelis pubescens Fabr.

Thick, cylindric, brilliant, brassy, coppery hued, rather stout beetles occur on hard pine foliage in May and June.

This species ranges from 3/8 to 5/16 inch in length [pl. 20, fig. 7]. It was common on hard pines at Karner in June 1901, and occurred throughout May, June and early July the following year. This insect ranges from the Middle States to North Carolina and has been recorded from Oregon. It appears to be a rather characteristic spruce and pine beetle, judging from accessible records.

Cryptocephalus schreibersii Suffr.

A stout, yellowish brown beetle a trifle over 1/8 inch long occurs on hard pine.



Fig. 216 Cryptocephalus schreibersii, enlarged (original)

This stout yellowish brown beetle, only a trifle over 1/8 inch in length, was taken in small numbers on hard pines at Karner in September. This species has been recorded by Dr LeConte, from Massachusetts and Georgia, and Dr Smith reports it from several localities in New Jersey, and states that it occurs on hard pine leaves.



Fig. 217 Cryptocephalus quadrimaculatus, enlarged (original)

Cryptocephalus quadrimaculatus Say

A small, stout, black, red-spotted beetle 1/4 inch long occurs on hard pines in midsummer.

This species was taken through June and in early July 1901, and the latter part of June 1902, on both scrub oak and hard pine at Karner. It has also been listed from New Jersey tea (Ceanothus americana) and also on Rubus. Little is known of its life history.

Notoxus bifasciatus Lec.

A small, brown or blackish beetle with lighter transverse bands on the wing covers and a conspicuous pronotal process.

This small beetle only about $\frac{1}{8}$ inch long, was exceedingly common on hard pine at Karner during the latter part of June and early July 1902. It could have been taken by thousands, if desired. This species, like its ally, N. anchora Hentz, has the peculiar hornlike process on the prothorax, only in this case it is distinctly spatulate at the tip. The elytra are dark brown or black with two transverse bands, the anterior one always being interrupted at the suture.



Fig. 218 Notoxus bifasciatus, enlarged (original)

This species, according to Dr Horn, occurs everywhere from Canada to Arizona, westward to the Rocky mountains. It is stated by Dr Smith to be locally common, and Dr Hamilton records it as abundant in southwestern Pennsylvania, along the river shore on herbage, willow etc.

Notoxus anchora Hentz

A small brown, black-marked beetle about $\frac{1}{8}$ inch in length, may be met with on hard pine and various shrubs and herbs during the summer.

Members of this genus are remarkable for the enormous hornlike projection on the prothorax. This species is somewhat variable, though Dr Horn states that the markings are rather constant. There is usually a more or less crescentic black band on each wing cover at the apical third. These join at the suture and extend forward, becoming broader at base. Near the side margin, just behind the humeri, there is a short stripe of varying size, sometimes wanting. This species is widely distributed, though it has not been observed in Arizona or the Pacific States. It appears in most of the local lists, except in that for the District of Columbia, and is usually recorded as rather scarce. Large numbers of this



Fig. 219 Notoxus anchora, enlarged (original)

species have been sent to us by a correspondent, who took them from about the roots of wheat plants.

Coenus delius Say

A yellowish brown, black-dotted, somewhat oval plant bug 3/8 inch long.

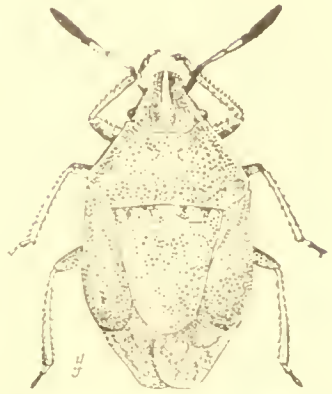


Fig. 22[illegible] Coenus delius, enlarged (Original)

This yellowish brown, black-dotted, somewhat oval plant bug, measuring about 3/8 inch in length, was taken at Karner on hard pine in 1901. The species has a wide range, it having been listed from Colorado, New Jersey, Iowa, and Professor Uhler records it from as far south as Texas and as occurring in Massachusetts, New York and other states.

Lace-winged fly

Hemerobius stigmaterus Fitch

Delicate greenish or brownish lace-winged flies with golden eyes, occur on many plants, their flattened long-jawed ferocious larvae devouring plant lice.

These flies are rather well known both as adults and larvae. The above named species was found in small numbers on hard pine at Karner. It appears to be a common species according to Dr Fitch, in the Northern and Western States. The general appearance of a lace-winged fly is shown at plate 20, figure 18. The peculiar spheric cocoon is illustrated at 18a of the same plate and the singular stalked eggs at 18b. The young aphis lions are very bloodthirsty, even attacking smaller larvae of their own species as well as destroying many aphids.

Micromus montanus Hag.

This grayish brown, lace-winged fly 1/4 inch long with a wing spread of 3/4 inch occurs in September on hard pine. The veins are prettily marked with irregular alternating light and brown spaces. This beneficial species has been recorded from Massachusetts and the White mountains.

Pine tree cricket

Oecanthus pini Beutm.

This flower cricket was taken by the writer on hard pine at Karner in 1901 as follows; July 27, four; Aug. 21, four, and Sep. 6, one. Immature specimens of what probably belong to the same species were taken, one on July 8, and two on the 19th.

This insect has been described by Mr Beutenmuller as follows:

Head and antennae testaceous, the latter becoming darker towards the tip; first two joints with four black marks; the inner mark on the first joint long and straight, the outer oblique; those on the second joint parallel; eyes black; thorax testaceous with a longitudinal line on each side above; anterior pairs of legs testaceous; posterior femora green, tibiae testaceous; body beneath black with the sides yellowish green; body above blackish with a green stripe along the back; elytra transparent, with grass-green veins; hind wings slightly protruding beyond the elytra; veins also green.



Fig. 221 Oecanthus pini, under side of basal antennal segments (After Beutenmuller, Am. Mus. Nat. Hist. Bul. '94)

The female is somewhat paler than the male, and the wings extend a little more beyond the elytra; ovipositor dark testaceous, tip black. Average length from head to tip of wing covers, 14 mm; body, 12 mm; width, 4.5 mm.

He states that it may be easily distinguished from O. nigricornis Walk., by the grass-green color of the wings and the testaceous head and thorax and the marks on the basal joints of the antennae. He adds that it lives only on pinetrees and usually on the high branches. It has been recorded from Riverton N. J., by Dr Smith and probably occurs in other pine sections of the state.

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Black-horned tree cricket

Oecanthus nigricornis Walker

This tree cricket may be recognized by its dark or nearly black antennae, the black markings on the basal joints as illustrated in figure 222, and by the rufous and dark markings upon the head and abdomen. It is somewhat variable in coloring, though possessing a characteristic appearance.

This species occurred in small numbers on hard pine at Karner in 1901, and was as abundant as any other species of this genus in that section. Adults were taken in August and September, and the species is undoubtedly of some benefit to trees because of its predaceous habits, though shrubs, particularly those with soft wood, may be injured to a considerable extent by the deposition of eggs. This insect was noticed by Dr Fitch in 1856, who states that it is almost as common as the snowy tree cricket (Oecanthus niveus DeG.), and who treated of it under the name of O. fasciatus DeGeer. This species occurs from the latter part of July till frost, along roadsides and in open fields, according to Mr Beutenmuller, who considers it one of the most common in the vicinity of New York city. Professor Bruner states that it is almost as abundant in Nebraska as the snowy tree cricket, and that it is a frequenter of meadows and may be found among weeds and grasses, depositing eggs as a rule, in weed stems. Professor Lugger considers it a very common form in Minnesota. It is interesting to note that it occurs in Mississippi, where Mr W. H. Ashmead detected a small parasite, Antigaster mirabilis Walsh ovipositing in the cricket's eggs.



Fig. [illegible] Oecanthus [illegible], ♂, dorsal side of basal antennal segments (After Beutenmuller, Am. Mus. Nat. Hist. Bul. 6:270)

Bibliography

1894 **Beutenmuller, Wm.** Am. Mus. Nat. Hist. Bul. 6: 270

Four-spotted tree cricket

Oecanthus quadripunctatus Beutm.

This species occurs in small numbers during early fall on hard pine at Karner. It has been recorded from Ithaca, Staten Island and a number of

New Jersey localities. It may be recognized by aid of the figure and the following description by Mr Beutenmuller.



Fig. 223 Oecanthus quadripunctatus, underside of basal antennal segments (After Beutenmuller, Am. Mus. Nat. Hist. Bul. '94)

Head and antennae testaceous, the latter becoming darker towards the tip; first two joints with four black marks; the inner mark on the first joint long and straight, the outer oblique; those on the second joint parallel; eyes black; thorax testaceous with a longitudinal line on each side above; anterior pairs of legs testaceous; posterior femora green, tibia testaceous; body beneath black with the sides yellowish green; body above blackish with a green stripe along the back; elytra transparent, with grass-green veins; hind wing slightly protruding beyond the elytra; veins also green.

The female is somewhat paler than the male, and the wings extend a little more beyond the elytra; ovipositor dark testaceous, tip black. Average length from head to tip of wing covers, 14 mm; body, 12 mm; width, 4.5 mm.

SUPPLEMENTAL BIBLIOGRAPHIC AND DESCRIPTIVE CATALOGUE

The following list comprises a large number of species which have been observed upon various shade and forest trees. These insects are very rarely abundant enough to cause any material injury, yet their identification is necessary if one would be certain that he has not some more destructive form. References are given to records of food habits and also to descriptions of immature stages. These latter will prove of great value to all working entomologists, since it will enable them to ascertain readily whether a certain caterpillar has been described or not. The more striking larval characters have been included because they will assist in eliminating many species, and thus save much labor in referring to the literature. Many references are given to Packard's well known *Insects Injurious to Forest and Shade Trees*, fifth report of the United States Entomological Commission. These are so numerous that in the interest of brevity, the name of the author is given in abbreviated form, followed by the page whenever the volume contains more than a record of food habits. We have endeavored to select the best available larval description, and, as a rule, food plant records compiled from other authors follow the reference.

OAK BORERS

Synchita obscura Horn, red oak. Ins. N. J. p. 225
Cucujus clavipes Fabr., hickory, maple, locust, buckeye, gum. Hamilton. Can. Ent. 18:27. Linden
Sandalus petrophya Knoch, white oak. Psyche, 4:203
Melasis pectinicornis Mels. Ins. N. J. p. 245
Athous cucullatus Say. Pack.
Coelostethus notatus Say. Am. Ent. Soc. Trans. 31:187
Elater sayi Lec. Ins. N. J. p. 248
Elater nigricollis Herbst. Pack.
Buprestis rufipes Oliv., beech. Ins. N. J. p. 254
Dicerca asperata Lap. & Gory. Pack. Hickory
Chrysobothris scitula Gory, in white oak bark. Pack. p. 69
Agrilus obsoletoguttatus Gory. Am. Ent. Soc. Trans. 18:317. Beech
Agrilus interruptus Lec. Ent. Am. 5:32
Agrilus acutipennis Mann. Am. Ent. Soc. Trans. 18:307
Cinyra gracilipes Mels., white oak. Ent. Am. 5:30
Xenorhipis brendeli Lec. Ent. Am. 5:31
Mastogenius subcyaneus Lec. Ins. N. J. p. 256. Hop hornbeam
Bostrichus bicornis Web., under bark. Pack. p. 92
Dinoderus punctatus Say. Pack.
Lucanus dama Thunb. Can. Ent. 13:118. Willow
Ceruchus piceus Web. Decaying oak, black cherry
Parandra brunnea Fabr. Ent. Soc. Wash. Proc. 3:96. Beech, linden, wild cherry
Hymenorus obscurus Say. Wickham. N. Y. Ent. Soc. Jour. 4:121
Hymenorus communis Lec. Pack.
Androchirus fuscipes Mels. Pack.
Dendroides canadensis Latr. Pack.
Smodicum cucujiforme Say, beech, hackberry. N. Y. Ent. Soc. Jour. 4:74

Phymatodes varius Fabr., black oak, Pack. p. 76. Hickory
Dryobius sexfasciatus Say. Pack. p. 227. Beech, elm, maple
Romaleum rufulum Hald. Ins. N. J. p. 287
Elaphidion inerme Newm., orange. N. Y. Ent. Soc. Jour. 4:75
Elaphidion subpubescens Lec., white oak. U. S. Div. Ent. Bul. 18, n. s. p. 41
Elaphidion mucronatum Fabr., hackberry. N. Y. Ent. Soc. Jour. 4:75
Elaphidion unicolor Rand., redbud. Ins. N. J. p. 288
Curius dentatus Newm. Ins. N. J. p. 288
Tragidion coquus Linn. var. **fulvipenne** Say. Pack. p. 91
Purpuricenus humeralis Fabr. N. Y. Ent. Soc. Jour. 4:76. Maple
Microclytus gazellula Hald. N. Y. Ent. Soc. Jour. 4:77
Cacoplia pullata Hald. N. Y. Ent. Soc. Jour. 4:78
Cyrtinus pygmaeus Hald., hickory, box elder, locust. Ins. N. J. p. 293
Goes debilis Lec., white oak, chestnut. Pack. p. 82. Hickory
Goes tessellata Hald. N. Y. Ent. Soc. Jour. 4:78
Acanthoderes quadrigibbus Say, oak twigs. Pack. p. 91. Hickory, beech, hackberry
Leptostylus parvus Lec. Am. Ent. Soc. Trans. 22:369. Box elder
Typocerus zebratus Fabr., white oak. Wickham. Can. Ent. 29:188
Leptura nitens Forst. Wickham. Can. Ent. 29:192
Ataxia crypta Say, hackberry, box elder. N. Y. Ent. Soc. Jour. 4:80
Cryptorhynchus minutissimus Lec. Ins. N. J. p. 353
Cryptorhynchus ferratus Say. N. Y. Ent. Soc. Jour. 1:83
Cryptorhynchus bisignatus Say. N. Y. Ent. Soc. Jour. 1:83. Chestnut, beech
Cryptorhynchus tristis Lec. N. Y. Ent. Soc. Jour. 1:83
Copturodes quercus Say. Ins. N. J. p. 354
Copturodes longulus Lec. Ins. N. J. p. 354
Zygomicros minutus Lec. Ins. N. J. p. 354
Pityopthorus querciperda Schwz., oak bark. Pack. p. 93
Pityopthorus fagi Hop. Ins. N. J. p. 362
Pityopthorus frontalis Hop. Ins. N. J. p. 362
Hypothenemus aveccae Horning. Ins. N. J. p. 362
Hypothenemus erectus Lec. Pack. Hickory
Stephanoderus dissimilis Zimm. Ins. N. J. p. 362
Xyleborus pubescens Zimm., butternut, chestnut, magnolia, cherry. Ins. N. J. p. 363
Micracis opacicollis Lec. Ins. N. J. p. 363
Thysanoes quercus Hop., chestnut. Ins. N. J. p. 363
Corthylus columbianus Hop. Ent. Soc. Wash. Proc. 3:104

OAK LEAF FEEDERS

Sawfly larvae

Periclista albicollis Nort., greenish; conical tubercles; white oak. Dyar. N. Y. Ent. Soc. Jour. 6:130
Periclista media Nort., green; white oak. Dyar. N. Y. Ent. Soc. Jour. 6:132
Periclista purpuridorsum Dyar, greenish white, thorax greenish; white oak. N. Y. Ent. Soc. Jour. 6:130
Periclista subtruncata Dyar, smooth waxy greenish; black oak. N. Y. Ent. Soc. Jour. 6:132

Periclista emarginata MacGill., pale spined, green. Dyar. N. Y. Ent. Soc. Jour. 6:131
Isodyctium infrequens Dyar, white spined, green; white oak. N. Y. Ent. Soc. Jour. 6:135
Isodyctium subgregarium Dyar, black spined, green; white oak. N. Y. Ent. Soc. Jour. 6:134
Isodyctium murtfeldtiae Dyar, green, spined; black oak. N. Y. Ent. Soc. Jour. 6:135
Nematus chloreus Nort., whitish green. Dyar. N. Y. Ent. Soc. Jour. 6:123
Pteronus integer Say, green, dark behind eye. Dyar. N. Y. Ent. Soc. Jour. 6:122
Pteronus quercus Marlatt, yellowish or dark green. Dyar. N. Y. Ent. Soc. Jour. 6:122
Hemichroa albidovariata Nort., brown, black spots laterally. Dyar. N. Y. Ent. Soc. Jour. 6:125
Hemichroa fraternalis Nort., greenish, with dark lateral band. Dyar. N. Y. Ent. Soc. Jour. 6:124
Hemichroa phytophagica Dyar, green. N. Y. Ent. Soc. Jour. 6:125
Monophadnus dilutus Cress., pale green, 5/8 in. Pack. p. 206
Monostegia quercusalbae Nort., pale green. Pack. p. 205
Monostegia quercuscoccineae Dyar, white, black oak. Can. Ent. 26:42

Beetles

Brachys aeruginosa Gory. Ent. Am. 5:32. Beech.
Dichelonycha fuscula Lec. Am. Ent. Soc. Trans. 27:283
Lachnosterna quercus Knoch. Pack.
Systena taeniata Say. Pack.
Chlamys plicata Fabr., yellow case-bearer, 1/4 in. Pack. p. 205. Sycamore, hazel, birch, alder, sweet fern, blackberry
Bassareus detritus Oliv. Ent. Soc. Wash. Proc. 2:263
Cryptocephalus mutabilis Mels., hazel. Ins. N. J. p. 302
Cryptocephalus guttulatus Oliv. Am. Ent. Soc. Trans. 22:370
Metachroma laevicollis Cress. Ins. N. J. p. 305
Metachroma pallida Say. Ins. N. J. p. 305. Poplar
Metachroma quercata Fabr., scrub oak. Ins. N. J. p. 305
Xanthonia decemnotata Say. Am. Ent. Soc. Trans. 22:370
Xanthonia villosula Melsh. Am. Ent. Soc. Trans. 22:370. Hickory, hazel, poplar
Odontota nervosa Panz., miner, elm. Ent. Soc. Ont. 13th Rep't, p. 61. Linden
Xylopinus saperdoides Oliv. Pack.
Strongylium terminatum Say. Pack.
Eugnamptus angustatus Herbst., hickory, sycamore, butternut, chestnut. Ins. N. J. p. 339
Rhynchites aeratus Say, scrub oak. Ins. N. J. p. 339
Attelabus nigripes Lec., scrub oak. Ins. N. J. p. 340
Pterocolus ovatus Fabr. N. Y. Ent. Soc. Jour. 1:37
Piazorhinus pictus Lec. Am. Ent. Soc. Trans. 22:376
Piazorhinus scutellaris Say, hickory. N. Y. Ent. Soc. Jour. 1:81
Laemosaccus plagiatus Fabr. N. Y. Ent. Soc. Jour. 1:82. Hickory
Balaninus uniformis Lec. Pack.
Balaninus quercus Horn. Pack.

Caterpillars

Papilio glaucus Linn. var. **turnus** Linn., green, yellow and black marked, 1 3/5 in.; ash, linden, tulip, sassafras, apple, quince, plum, thorn, poplar, birch, alder. Am. Mus. Nat. Hist. Bul. 5 : 244

Basilarchia archippus Cram., whitish or olive-green, mottled, horned; plum, willow, poplar. French. Butt. East. U. S. p. 212

Basilarchia astyanax Fabr., greenish yellow, tuberculate. Pack. p. 128. Hornbeam, huckleberry, gooseberry, apple, plum, cherry, thorn

Thecla edwardsii Saund., dark green. Pack. p. 130

Thecla calanus Hübn., yellowish or green, white haired, 1/2 in.; hickory, walnut, butternut, chestnut, thorn. Beut. Am. Mus. Nat. Hist. Bul. 5 : 278

Thecla liparops Boisd. & Lec., green, brown humped, 1/2 in.; chestnut, apple, plum, cherry, thorn, willow, holly. Beut. Am. Mus. Nat. Hist. Bul. 5 : 279

Thanaos brizo Boisd. & Lec., scrub oak. Pack. p. 131

Thanaos juvenalis Fabr., green, yellow lined and dotted, 1 in. Beut. Am. Mus. Nat. Hist. Bul. 5 : 301

Anisota virginiensis Dru., yellow, rosy striped, prickly, 2 1/5 in. Pack. Nat. Acad. Sci. Mem. 9 : 102

Haploa clymene Brown. Pack.

Charadra deridens Guen., white, with tufts of silky white hair; elm, birch. Sm. & Dyar. U. S. Nat. Mus. Proc. 21 : 25

Apatela afflicta Gr., brown, with black dorsal stripe. Sm. & Dyar. U. S. Nat. Mus. Proc. 21 : 127

Apatela brumosa Guen., olive-green, yellowish, banded. Sm. & Dyar. U. S. Nat. Mus. Proc. 21 : 117. Hickory, witch-hazel, plum, willow, birch

Apatela hamamelis Guen., brown, blackish dorsal stripe; horse-chestnut, chestnut, birch. Sm. & Dyar. U. S. Nat. Mus. Proc. 21 : 141

Apatela lobeliae Guen., gray, yellow marked, 1/2 in. Pack. p. 168. Cherry

Apatela modica Walk., brown shaded, blackish. Sm. & Dyar. U. S. Nat. Mus. Proc. 21 : 139

Apatela ovata Grote, brown, yellow marked; chestnut, beech, birch. Sm. & Dyar. U. S. Nat. Mus. Proc. 21 : 135

Pyrophila pyramidoides Guen., green, white dotted, 1 2/5 in.; hickory, walnut, chestnut, maple, box elder, linden, apple, cherry, lilac, willow, poplar. Beut. Am. Mus. Nat. Hist. Bul. 16 : 452. Hazel

Rhynchagrotis alternata Gr., dark brown, white lined. Dyar. Ent. Soc. Wash. Proc. 4 : 316. Hickory

Psaphidia thaxterianus Grote, brown, green tinted, with creamy patches; white oak. Dyar. N. Y. Ent. Soc. Jour. 9 : 84

Peridroma margaritosa Haw. var. **saucia** Hübn., mottled, gray, 1 1/2 in. Pack. p. 173

Mamestra atlantica Grote, greenish or brown, 1 1/16 in. Fletcher & Gibson. Can. Ent. 34 : 279

Graphiphora alia Guen., whitish, red marked. Pack. p. 172. Hickory, sassafras, birch

Crocigrapha normani Grote. Can. Ent. 23 : 36

Jodia rufago Hübn., yellow, black marked. Pack. p. 172

Calymnia orina Guen., whitish green, 9/10 in. Beut. Am. Mus. Nat. Hist. Bul. 16 : 457

Scopelosoma devia Grote, dark green, gray or blackish, with dark dorsal band, $1\frac{1}{4}$ in. Thaxter. Can. Ent. 16: 33

Scopelosoma morrisoni Grote, black, greenish, bluish white marks, $1\frac{1}{2}$ in. Thaxter. Can. Ent. 16: 30

Scopelosoma sidus Guen., dark olive-green, purplish markings, $1\frac{1}{4}$ in. Thaxter. Can. Ent. 16: 33. Hickory, apple, wild cherry, peach

Scopelosoma tristigmata Grote, dark olive-green, orange yellow lined, $1\frac{1}{2}$ in. Thaxter. Can. Ent. 16: 33

Scopelosoma walkeri Grote, velvety black, purplish white lined, $1\frac{1}{4}$ in. Thaxter. Can. Ent. 16: 31

Scolecocampa liburna Geyer, black headed, whitish, brown spotted, $1\frac{3}{4}$ in.; chestnut. Edw. & Elliot. Papilio, 3: 134

Catocala amasia Abb. & Sm. Pack. p. 175

Catocala amica Hübn., slender, greenish yellow, black marked, $1\frac{1}{4}$ in. Pack. p. 174

Catocala coccinata Grote, dark gray, black marked, $2\frac{1}{2}$ in. Coq. Papilio, 1: 50

Catocala epione Drury, reddish gray, bluish marbled. Pack. p. 178. Hickory

Catocala fratercula Gr. & Rob., gray, black spotted, white marked, $1\frac{3}{4}$ in. Coq. Papilio, 1: 7

Catocala ilia Cram., greenish gray, blue, gray marked. Pack. p. 177

Catocala lacrymosa Guen., walnut. Pack. p. 178. Black walnut

Catocala polygama Guen., ash-gray, dark marked, $2\frac{1}{2}$ in. Pack. p. 179. Thorn

Catocala similis Edw., greenish gray. Pack. p. 175

Catocala ultronia Hübn., dull grayish brown, $1\frac{5}{16}$ in. Pack. p. 176

Catocala vidua Abb. & Sm., greenish gray, black marked. Pack. p. 178. Hickory, black walnut, locust, willow

Panapoda rufimargo Hübn., dark green, yellow marked, $1\frac{5}{8}$ in. Pack. p. 172. Wild cherry

Zanclognatha protumnusalis Walk. Pack.

Palthis asopialis Guen. Pack.

Hyperaeschra georgica H.-S., green, white lined, red dotted, $1\frac{1}{2}$ in. Pack. Monogr. Bombycine Moths, p. 153

Lophodonta angulosa Abb. & Sm., green, white lined, white dotted. Pack. Monogr. Bombycine Moths, p. 147

Heterocampa manteo Dbldy., green, purple and white marked, $1\frac{1}{4}$ in.; walnut, linden, apple, hawthorn, birch, persimmon. Pack. Monogr. Bombycine Moths, p. 224

Heterocampa obliqua Pack., gray headed, white or green, many brownish dots. Pack. Monogr. Bombycine Moths, p. 242

Heterocampa umbrata Walk., green, white marked, $1\frac{1}{4}$ in. Pack. Monogr. Bombycine Moths, p. 249. Hickory, black walnut, hornbeam, birch

Ianassa lignicolor Walk., green, brown marked; hump on first abdominal segment, $1\frac{3}{8}$ in.; beech, birch. Pack. Monogr. Bombycine Moths, p. 190. Chestnut

Schizura ipomoeae Dbldy., brown, green marked; humps on first, fifth, eighth abdominal segments, $1\frac{1}{4}$ in.; elm, maple, honey-locust, birch. Pack. Monogr. Bombycine Moths, p. 104. Witch-hazel, linden

Schizura unicornis Abb. & Sm., lilac, light marked larva; hump on first and eighth abdominal segments; sides of thorax green, $1\frac{1}{4}$ in.; hickory, blackberry, winterberry, elm, apple, plum, thorn, dogwood, rose, willow, birch, alder and probably hazel, locust, cherry, poplar, holly. Pack. Monogr. Bombycine Moths, p. 203

Fentonia marthesia Cram., green, yellow and red marked, long tailed, 3/4 in.; beech. Pack. Monogr. Bombycine Moths, p. 257

Pseudothyatira cymatophoroides Guen., yellowish brown, white marked, 1 1/2 in. Pack. p. 167

Alsophila pometaria Harr., green, white lined spanworm. Dyar. Psyche, 9: 262 Hickory, hop-hornbeam

Tephroclystis miserulata Grote, green, brown marked, 3/4 in. Pack. p. 190. Tamarack, cedar, juniper

Epirrita dilutata Denis & Schiff., dirty green, red spotted spanworm. Pack. p. 233

Eustroma diversilineata Hübn., dark brown, reddish tinted spanworm. Pack. p. 189. Elm, woodbine

Mesoleuca gratulata Walk. Dyar. Psyche, 10: 191

Nemoria subcroceata Walk., brownish, white specked, tuberculate spanworm. Dyar. Psyche, 8: 386

Aplodes mimosaria Guen., dingy brown spanworm with curved lateral appendages. Pack. p. 189

Orthofidonia vestaliata Guen., hornbeam, apple. Ins. N. J. p. 445

Paraphia subatomaria Wood var. **unipuncta** Haw., gray, black marked spanworm, 1 1/10 in. Pack. p. 185. Elm

Cingilia catenaria Drury, yellow, black, brown marked spanworm. Dyar. Psyche, 9: 250. General feeder. Hazel, pine, juniper

Plagodis fervidaria H.-S., pale yellowish, black marked spanworm, 1 1/2 in. Pack. p. 186. Beech, ash, cherry, birch, spruce

Therina athasiaria Walk., greenish, black marked, orange shaded spanworm. Dyar. Psyche, 9: 10. Pine

Therina endropiaria Gr. & Rob., whitish, black marked spanworm, 1 3/8 in. Pack. p. 186. Chestnut, hornbeam

Euchlaena johnsonaria Fitch, cherry. Ins. N. J. p. 450

Euchlaena pectinaria Denis & Schiff., large, gray spanworm. Pack. p. 184. Poplar

Metanema quercivoraria Guen., pale green, red marked spanworm. Pack. p. 182. Elm, willow, poplar

Metanema textrinaria Gr. & Rob., red headed, green and red marked humped spanworm. Pack. Monogr. Geometrid Moths. p. 508

Nola ovilla Grote, hairy, white, black marked. Dyar. Psyche, 7: 137

Roeselia minuscula Zell. var. **phylla** Dyar. N. Y. Ent. Soc. Jour. 6: 43

Lacosoma chiridota Grote, greenish, yellow lined, brown marked. Dyar. N. Y. Ent. Soc. Jour. 8: 180

Cicinnus melsheimeri Harr., brown or pale brown case-bearer. Pack. p. 142

Slug caterpillars

Euclea chloris H.-S., greenish, salmon lined. 3/4 in.; hickory, bayberry, chestnut, elm, linden, wild plum, wild cherry, Dyar. N. Y. Ent. Soc. Jour. 5: 61

Euclea delphinii Boisd., green, yellow marked, red horned; chestnut, beech, bayberry, honey-locust, wild cherry, sour gum. Dyar. N. Y. Ent. Soc. Jour. 5: 57

Adoneta spinuloides H.-S., green, purple dorsally; a red and a shorter yellow horn, 2/5 in.; chestnut, beech, witch-hazel, bayberry, locust, linden, plum, wild cherry, sour gum, willow, birch. Dyar. N. Y. Ent. Soc. Jour. 5: 9

Prolimacodes scapha Harr., green mottled, brown or yellow, $\frac{2}{3}$ in.; hickory, chestnut, hop-hornbeam, witch-hazel, bayberry, maple, linden, wild cherry, sweet gum, birch. Dyar. N. Y. Ent. Soc. Jour. 4:172

Natada nasoni Grote, green, subdorsal reddish spots, $\frac{3}{4}$ in.; hickory, chestnut, beech, ironwood. Dyar. N. Y. Ent. Soc. Jour. 7:61

Packardia geminata Pack., whitish green, white lined, $\frac{3}{5}$ in. Dyar. Can. Ent. 23:277

Packardia elegans Pack., green, yellowish and dark spotted, $\frac{1}{2}$ in. Dyar. Can. Ent. 23:277

Heterogenea shurtleffii Pack., greenish, red spotted; chestnut, beech, ironwood, locust. Dyar. N. Y. Ent. Soc. Jour. 6:241

Kronaea minuta Reak., green, red lined. Pack. p. 150. Chestnut

Cochlidion biguttata Pack., whitish green, yellow lined, $\frac{1}{2}$ in. Dyar. N. Y. Ent. Soc. Jour. 5:168

Tortricidia testacea Pack., green; crimson, yellow marked, $\frac{1}{3}$ in.; wild cherry, birch. Ins. N. J. p. 487. Linden

Tortricidia pallida H.-S., green, red or purple marked, $\frac{1}{3}$ in.; sycamore, chestnut, witch-hazel, bayberry, maple, cherry, willow birch. Dyar. N. Y. Ent. Soc. Jour. 4:167

Leaf rollers

Exartema inornatanum Clem., white oak. Am. Ent. Soc. Trans. 10:30

Tmetocera ocellana Schiff., brown headed, light brown, $\frac{1}{2}$ in.; laurel oak. Fitch. 3d Rep't, p. 27

Cenopis reticulatana Clem., osage orange, maple, pear, persimmon. Pack. p. 194

Cenopis diluticostana Wlsm., cultivated cherry. Pack. p. 194

Archips grisea Robs. Am. Ent. Soc. Trans. 10:13

Archips semiferana Walk. Pack. p. 192. Hickory, box elder

Pandemis limitata Robs. Am. Ent. Soc. Trans. 10:14

Tortrix albicomana Clem. Am. Ent. Soc. Trans. 10:18. Rose

Eulia velutinana Walk., maple, balsam. Pack. p. 196

Aristotelia rubidella Clem., green, purple striped and dotted. Murt. Can. Ent. 6:222

Telphusa quercinigracella Chamb., black marked, yellowish; black oak. Can. Ent. 4:171

Telphusa querciella Chamb., brown headed, whitish, purple spotted. Clem. Can. Ent. 4:128

Recurvaria quercivorella Chamb., white, red spotted; in silken tube. Clem. Can. Ent. 4:173

Trypanisma prudens Clem., ovoid larva beneath web on under surface of leaf. Tineina N. A. p. 126

Epithectis gallaegenitella Clem., in spongy gall tissues. Tineina N. A. p. 243

Ypsolophus ligulellus Hübn., striped, white and black, $\frac{6}{10}$ in. Pack. p. 202

Ypsolophus quercicellus Chamb., grayish or greenish, reddish tinged, 1 in. Can. Ent. 4:223

Aristotelia rubidella Clem. Pack.

Gelechia bicostomaculella Chamb., yellowish; head and thorax dark brown. Clem. Can. Ent. 4:207

Paralechia cristifasciella Chamb., dark green, red banded. Pack. U. S. Div. Ent. Bul. 32:56

Gelechia vernella Murt., gray: purple or red lined larva, laurel oak. Can. Ent. 13:244
Stenoma schlaegeri Zell., flattened, pale green, 7/8 in. Pack. p. 197
Cryptolechia quercicella Clem., brown headed, greenish, black marked, 1/2 in.; in leafy nest. U. S. Div. Ent. Bul. 13:27
Machimia tentoriferella Clem., large headed, green tapering larva under web near midrib, hickory and wild cherry. Tineina N. A. p. 148
Euclemensia bassettella Clem. Pack.

Leaf miners

Coleophora querciella Clem., dark brown, pistol-shaped case. Tineina N. A. p. 168
Nepticula anguinella Clem., linear, serpentine mine full of black frass. Tineina N. A. p. 175
Nepticula saginella Clem., transparent, medium, serpentine; central frass line. Tineina N. A. p. 175
Nepticula quercipulchella Chamb. Pack.
Nepticula quercicastanella Chamb. Pack.
Nepticula platea Clem., mine moderate, winding, scattered frass line. Tineina N. A. p. 175
Lithocolletes albanotella Chamb., tentiform mine on under surface. Cin. Quar. Jour. Sci. 2:102
Lithocolletes aeriferella Clem. Ent. Soc. Wash. Proc. 5:187
Lithocolletes argentifimbriella Clem., tentiform, marginal mine under folded leaf edge. Chamb. Cin. Quar. Jour. Sci. 2:103
Lithocolletes blancardella Fabr., mine on underside near midrib. Clem. Tineina N. A. p. 141. Wild cherry, thorn
Lithocolletes bethuniella Chamb. Pack.
Lithocolletes bifasciella Chamb. Pack.
Lithocolletes basistrigella Clem., blister mine, under surface. Tineina N. A. p. 70
Lithocolletes cincinnatiella Chamb. Psyche. 2:83
Lithocolletes fasciella Walsm., oval, flat, upper surface, later corrugated in middle. Chamb. Cin. Quar. Jour. Sci. 2:103
Lithocolletes hageni Frey & Boll. Pack.
Lithocolletes obstrictella Clem., cylindric, yellow larva in mine, under surface, black oak. Tineina N. A. p. 74
Lithocolletes quercialbella Fitch., marginal mine, under surface. Chamb. Cin. Quar. Jour. Sci. 2:102
Lithocolletes tubiferella Clem., serpentine frass-lined tract, upper surface. Tineina N. A. p. 140
Coriscium albinatella Chamb. Pack.
Tischeria fuscomarginella Chamb., marginal mine below under curled edge. Cin. Quar. Jour. Sci. 2:110
Tischeria pruinosella Chamb. Pack.
Tischeria badiiella Chamb., whitish blotch mine, upper surface. Cin. Quar. Jour. Sci. 2:109
Tischeria citrinipennella Clem., white, blotch mine, upper surface. Tineina N. A. p. 82. Ash
Coptotriche zelleriella Clem., white or brown blotch mine, upper surface. Tineina N. A. p. 81
Argyresthia austerella Zell., chestnut. Ins. N. J. p. 481

Sucking insects

Thelia univittata Harr., brown, white-lined tree hopper, $\frac{4}{10}$ in., on twigs. Pack. p. 98

Aphids or plant lice

Lachnus quercifoliae Fitch. Pack.
Schizoneura querci Fitch, black aphids, $\frac{1}{8}$ in. Pack. p. 213
Chaitophorus spinosus Oestl., orange or yellow aphid, $\frac{1}{10}$ in. Pack. p. 213
Callipterus bellus Walsh. Ins. N. J. p. 104
Callipterus discolor Mon., dark rose colored aphid. Pack. p. 210
Callipterus hyalinus Mon. Ins. N. J. p. 104
Callipterus punctatus Mon. Pack. p. 210
Callipterus quercifolii Thom., brownish aphid with annulate antennae. Pack. p. 211
Aphis quercifoliae Walsh., pale greenish aphid. Pack. p. 209.

Scale insects

Eulecanium antennatum Sign. Fern. Coccidae, p. 181
Eulecanium lymani King, Fern. Coccidae, p. 190
Eulecanium quercitronis Fitch, $\frac{2}{10}$ in.; black oak. Pack. p. 98. Ironwood
Eulecanium quercifex Fitch, $\frac{3}{10}$ in. Pack. p. 98
Kermes andrei King, brown, hemispheric; white oak. Psyche, 9:22
Kermes perryi King, scrub oak. Psyche, 9:81
Kermes pettiti Ehrh., brown, hemispheric. King. Psyche, 9:81
Kermes kingii Ckll., red oak. Fern. Coccidae, p. 63
Kermes nivalis King & Ckll., brown, hemispheric; white oak. King. Psyche, 9:80
Kermes pubescens Bogue. Fern. Coccidae, p. 64
Kermes quercus Linn. Fern. Coccidae, p. 64
Eriococcus quercus Comst. Fern. Coccidae, p. 78
Sphaerococcus sylvestris Ckll., white oak. Can. Ent. 30:326
Chrysomphalus obscurus Comst., hickory. Fern. Coccidae, p. 201

Acorn feeders

Holcocera glandulella Riley, yellow or grayish white larva. Chittenden. U. S. Div. Ent. Bul. 44:38
Melissopus latiferreanus Wlsm. Am. Ent. Soc. Trans. 10:51

OAK GALLS

Acorn galls

Andricus operator O. S. form operatola Riley & Bass., five or six galls in aborted acorns. Am. Ent. Soc. Trans. 26:315
Andricus perditor Bass., galled acorns exude a liquid. Am. Ent. Soc. Trans. 29:313

Twig galls and others

Andricus seminosus Bass., subconic, apical, $\frac{1}{2}$ to 1 in. Am. Ent. Soc. Trans. 17:76
Andricus gibbosus Prov. Nat. Can. 12:232
Andricus obtusilobae Bass. Am. Ent. Soc. Trans. 26:316

Amphibolips caroliniensis Bass., coarsely reticulated oak apple. Am. Ent. Soc. Trans. 17 : 85
Neuroterus exiguus Bass., aments enlarged, nodular. Am. Ent. Soc. Trans. 26 : 333
Neuroterus crassitelus Prov. Nat. Can. 12 : 232
Neuroterus dubia Bass. Am. Ent. Soc. Trans. 26 : 335
Cecidomyia majulis O. S., green or reddish blister gall. Am. Ent. Soc. Trans. 3 : 53
Cecidomyia niveipila O. S., pubescent folded rib gall. Diptera N. A. 1 : 199
Cecidomyia symmetrica O. S., small, globular, hard, red. Diptera N. A. 1 : 200
Phylloxera rileyi Licht., circular, yellow spot on underside. Pack. p. 208

WHITE OAK

Root gall

Biorhiza nigra Fitch. Nox. Ins. N. Y. 5 : 2

Twig galls

Andricus ? indistinctus Bass., globular, broad base, 1/8 in. diameter. Am. Ent. Soc. Trans. 17 : 81
Andricus tuber Fitch, irregular swellings thrice the size of the twig. Nox. Ins. N. Y. 5 : 26
Amphibolips badius Bass. Am. Ent. Soc. Trans. 26 : 323
Dryophanta radicola Ashm., yellow, fig-shaped, clustered. Insect Galls Ind. p. 836
Dryophanta pallipes Bass., apical enlargement with threadlike appendages. Am. Ent. Soc. Trans. 26 : 327
Cynips juglans O. S., round gall, 3/4 to 1 in. Ent. Soc. Phila. Proc. 1 : 255
Biorhiza loxaulis Mayr., woody knots at base of young shoots. Can. Ent. 13 : 76

Bud galls

Dryophanta clarkei Bass., round, smooth, diameter 3/16 in. Am. Ent. Soc. Trans. 17 : 69
Neuroterus minutus Bass., greatly enlarged petioles without leaf. Can. Ent. 13 : 96
Cynips vesicula Bass., smooth, brown, central. Can. Ent. 13 : 97

Leaf galls

Andricus cicatricula Bass., polythalamous, conical, midrib, 1/2 to 1/8 in. Am. Ent. Soc. Trans. 17 : 80
Andricus flocci Walsh, oval, 1/5 to 2/5 in. Ent. Soc. Phila. Proc. 2 : 482
Andricus foliaformis Gill., warty, leafy growth on underside of midrib. Psyche, 5 : 214
Andricus fusiformis O. S., fusiform, pedicellate, 1/5 in. Ent. Soc. Phila. Proc. 1 : 61
Andricus futilis O. S., spheric, on both sides, 1/4 in. Ent. Soc. Phila. Proc. 1 : 63
Andricus utriculus Bass., globular, green or purplish, 1/6 in. Can. Ent. 13 : 78
Neuroterus exiguissimus Bass., woolly, midrib gall, .03 in. Am. Ent. Soc. Trans. 26 : 332
Neuroterus pallipes Bass., small, hairy on stem or midrib. Am. Ent. Soc. Trans. 17 : 89
Neuroterus perminimus Bass., pustulate, abundant. Am. Ent. Soc. Trans. 26 : 332
Neuroterus majalis Bass., green, 1/4 to 1 in. Ent. Soc. Phila. Proc. 3 : 683

Neuroterus consimilis Bass., woody, polythalamous, ¾ in. Am. Ent. Soc. Trans. 26: 335
Philonix fulvicollis Fitch. Nox. Ins. N. Y. 5: 3
Philonix gillettei Bass., oval, tufted, pimply, .15 in. Am. Ent. Soc. Trans. 26: 323
Philonix nigricollis Fitch. Nox. Ins. N. Y. 5: 3
Biorhiza rubinus Gill., subglobular rosy; underside, ½ in. Psyche, 5: 215
Acraspis niger Gill., small, brown, globular, pubescent; underside of leaf. Gill. Ent. Am. 6: 23
Phylloxera querceti Perg., many small, yellow spots along veins; other oaks. Davenport Acad. Sci. Proc. 9: 263
Phylloxera rileyi Riley, yellowish, circular spots on post oak. Perg. Davenport Acad. Sci. Proc. 9: 261

SWAMP OAK

Twig galls

Holcaspis bassetti Gill., irregular, massed. Psyche, 5: 215
Neuroterus distortus Bass., leafy polythalamous gall, ½ in. Am. Ent. Soc. Trans. 26: 336
Neuroterus noxiosus Bass., large terminal or subterminal swellings. Can. Ent. 13: 108

Bud galls

Andricus ashmeadii Bass. Am. Ent. Soc. Trans. 26: 320
Andricus incertus Bass. Am. Ent. Soc. Trans. 26: 317
Amphibolips melanocera Ashm., globular bud axil gall. Am. Ent. Soc. Trans. 12: 299

Leaf galls

Andricus capsulus Bass., pedicellate, marginal, ⅜ in. Can. Ent. 13: 101
Andricus ignotus Bass., oval, sessile galls on midrib and veins. Can. Ent. 13: 106
Cynips floccosa Bass., many, small, hairy; under surface. Can. Ent. 13: 111
Cynips nigricens Gill., clustered, cone-shaped; under surface. Psyche, 5: 217

POST OAK

Twig gall

Dryophanta longicornis Bass., apical enlargement. Am. Ent. Soc. Trans. 26: 327

Leaf galls

Andricus pattoni Bass., clustered woolly galls along mid vein. Can. Ent. 13: 98
Andricus pruinosus Bass., round, thin, ⅛ to ¼ in. Am. Ent. Soc. Trans. 20: 311
Andricus quinqueseptum Ashm., globular petiole galls. Am. Ent. Soc. Trans. 12: 299
Andricus tubicola O. S., yellow tubular, red spined, ⅛ in. Ent. Soc. Phila. Proc. 1: 60
Holcaspis centricola O. S., globular, silky white, ¾ in. Ent. Soc. Phila. Proc. 1: 58
Neuroterus irregularis O. S., flattened, yellow galls, ⅓ in. Ent. Soc. Phila. Proc. 1: 65
Neuroterus verrucarum O. S., round, pubescent, ⅒ in. Ent. Soc. Phila. Proc. 1: 62

RED OAK

Twig galls

Amphibolips formosa Bass., elongate, oval, ¾ to 1 in. Ent. Soc. Phila. Proc. 3:679

Bud gall

Amphibolips cookii Gill., subglobular, acuminate, 1 in. Psyche, 5:220

Leaf galls

Andricus femoratus Ashm., globular, central, supported cell, diameter .3 in. Am. Ent. Soc. Trans. 14:141

Andricus modestus O. S., hard, irregular, green galls. Ent. Soc. Phila. Proc. 1:65

Andricus piperoides Bass., pubescent, clustered midrib gall, diameter ⅛ to ⅜ in. Am. Ent. Soc. Trans. 26:314

Amphibolips coelebs O. S., fusiform, pale green, 1 in. Ent. Soc. Phila. Proc. 1:60

Amphibolips sculpta Bass., globular, whitish, ¼ to ¾ in. Ent. Soc. Phila. Proc. 2:324

Dryophanta liberaecellulae Gill., globular, fuzzy, ½ in. Gill. Ent. Am. 6:24

Dryophanta papula Bass., many sharp points on upper surface of thickened portions; scarlet oak. Gill. Psyche, 5:187

Dryophanta pedunculata Bass., stemmed, ovate, curved; scarlet oak. Am. Ent. Soc. Trans. 17:72

SCARLET OAK

Ament gall

Neuroterus pallidus Bass., clustered, woody colored galls. Am. Ent. Soc. Trans. 17:88

Leaf galls

Andricus pusulatoides Bass., blisterlike, apical, diameter ⅓ by ⅕ in. Am. Ent. Soc. Trans. 17:74

Andricus saccularius Bass., pouch galls on underside, diameter 3/16 in. Am. Ent. Soc. Trans. 17:76

CHESTNUT OAK

Twig galls

Neuroterus rileyi Bass., irregular swellings on twig. Am. Ent. 3:153

SWAMP CHESTNUT OAK

Leaf gall

Andricus papillatus O. S., rounded, 1/16 in., with reddish aureole. Ent. Soc. Phila. Proc. 1:64

WILLOW OAK

Twig gall

Amphibolips phellos O. S., rounded swellings, ⅓ in. Ent. Soc. Phila. Proc. 1:70

QUERCUS MONTANA

Leaf gall

Biorhiza hirta Bass., round, on veins, ¼ in. Ent. Soc. Phila. Proc. 3:687

BLACK OAK

Twig gall

Andricus scitula Bass., subconical, $\frac{3}{4}$ to $1\frac{1}{2}$ in. Ent. Soc. Phila. Proc. 3:683

Leaf galls

Callirhytis tumifica O. S., midrib swellings. Ent. Soc. Phila. Proc. 4:356
Neuroterus favosus Bass., flattened polythalamous, $\frac{1}{4}$ to 1 in. Am. Ent. Soc. Trans. 17:87
Neuroterus pigra Bass., irregular midrib swellings; beneath. Can. Ent. 13:105

BLACK JACK OAK GALLS

Andricus operator O. S., round, woolly, seedlike grains within. Ent. Soc. Phila. Proc. 1:256
Andricus nigrae O. S., elongate midrib swellings. Ent. Soc. Phila. Proc. 1:66

BUR OAK

Leaf galls

Neuroterus flavipes Gill., hard, woody, midrib swelling, $1\frac{1}{4}$ in. Gill. Ent. Am. 6:21
Neuroterus vernus Gill., enlarged petioles or swollen catkins. Gill. Ent. Am. 6:22
Neuroterus nigrum Gill., clustered, pimplelike, $\frac{1}{12}$ in. Psyche, 5:218
Philonix villosus Gill., globular; underside of midrib, $\frac{5}{16}$ in. Psyche, 5:218
Philonix macrocarpae Bass., oval, faceted; lateral veins beneath. Am. Ent. Soc. Trans. 17:84
Eriophyes querci Garm., green, yellowish gall, $\frac{1}{10}$ to $\frac{1}{5}$ in. Pack. p. 213

SCRUB OAK

Twig galls

Andricus similis Bass., clavate, apical. Ent. Soc. Phila. Proc. 3:685
Andricus ventricosus Bass., truncate, cone-shaped, $\frac{1}{2}$ to $\frac{5}{8}$ in. Ent. Soc. Phila. Proc. 3:681
Cynips rugosa Bass., round, sessile galls, $\frac{1}{2}$ to $\frac{3}{4}$ in. diameter. Can. Ent. 13:106

Ament gall

Dryophanta clarkei Bass., black, polythalamous, .08 in. Am. Ent. Soc. Trans. 17:79

Bud galls

Andricus patiens Bass. Am. Ent. Soc. Trans. 26:312
Holcaspis fasciata Bass., apical clusters, mottled or banded. Am. Ent. Soc. Trans. 26:328
Amphibolips verna Bass. Am. Ent. Soc. Trans. 26:321
Neuroterus affinis Bass., round, thin, partly hidden by bud scales. Can. Ent. 13:103
Neuroterus corrugis Bass. Can. Ent. 13:109
Dryophanta gemula Bass., early acornlike, $\frac{1}{10}$ in. Can. Ent. 13:104
Dryophanta parvula Bass. Am. Ent. Soc. Trans. 26:326

Leaf gall

Andricus ostensackenii Bass., round, greenish yellow. Ent. Soc. Phila. Proc. 2:327

CHINQUAPIN OAK

Bud galls

Cynips frondosa Bass., Conical, $^1/_8$ in. Ent. Soc. Phila. Proc. 3:688
Andricus pulchellus Bass. Am. Ent. Soc. Trans. 26:314
Dryophanta corrugis Bass. Am. Ent. Soc. Trans. 17:71

TURKEY SCRUB OAK GALL

Andricus quercifoliae Ashm., globular, succulent; loose kernel. Am. Ent. Soc. Trans. 12:299

PIN OAK

Leaf gall

Andricus palustris O. S., globular, hollow $^1/_3$ in. Ent. Soc. Phila. Proc. 1:62

GUEST FLIES

Synergus albipes Walsh. Ent. Soc. Phila. Proc. 2:496
Synergus campanula O. S., in gall of Holcaspis globulus Fitch. Ent. Soc. Phila. Proc. 4:376
Synergus dimorphus O. S. Ent. Soc. Phila. Proc. 4:376
Synergus laeviventris O. S., in oak apple. Ent. Soc. Phila. Proc. 1:57
Synergus lignicolor O. S. Ent. Soc. Phila. Proc. 1:252
Synergus mendax Walsh, bred from galls of Andricus podagrae Walsh. Ent. Soc. Phila. Proc. 2:498
Synergus oneratus Harr., bred from gall of Andricus globulus. Ent. Soc. Phila. Proc. 2:498
Synergus rhoditiformis Walsh, in galls of Andricus podagrae. Ent. Soc. Phila. Proc. 2:499
Ceroptres arbos Fitch, C. tuber Fitch, guests of Andricus clavula Bass. Nox. Ins. N. Y. 5:29
Ceroptres petiolicola O. S., bred from gall of Andricus petiolicola. Ent. Soc. Phila. Proc. 1:67
Ceroptres ficus Fitch, guest of Biorhiza forticornis Walsh. Nox. Ins. N. Y. 5:32
Ceroptres inermis Walsh, in gall of Cecidomyia pilulae Walsh. Ent. Soc. Phila. Proc. 2:498
Ceroptres obtusilobae Ashm. Am. Ent. Soc. Trans. 12:300

PARASITES

Acraspis pezomachoides O. S. Ent. Soc. Phila. Proc. 1:250
Anacharis subcompressa Prov. Nat. Can. 12:237
Ibalia anceps Say. Compl. Wr. 1:218
Ibalia maculipennis Hald. Acad. Nat. Sci. Proc. 3:127
Eucoila stigmata Say. Compl. Wr. 2:717
Eucoila impatiens Say. Compl. Wr. 2:717
Eucoila pedata Say. Compl. Wr. 2:717
Eucoila mellipes Say. Compl. Wr. 2:718
Figites impatiens Say. Compl. Wr. 2:718
Figites chinquapin Fitch. Nox. Ins. N. Y. 5:40

Periclistis futilis O. S., in Andricus futilis gall. Ent. Soc. Phila. Proc. 1:64
Onychia armatus Say. Compl. Wr. 2:716
Onychia quinquelineata Say. Compl. Wr. 2:716
Aegilips obtusilobae O. S., from globular galls, ½ in. Ent. Soc. Phila. Proc. 1:68

HICKORY BORERS

Agrilus egenus Gory. Pack. p. 291. Locust
Anthaxia aeneogaster Lap. Hopk. W. Va. Agric. Exp. Sta. Bul. 32:182
Anthaxia viridifrons Gory, twig borer, ¼ in. Pack. p. 292. Elm
Acmaeodera culta Web. Hopk. W. Va. Agric. Exp. Sta. Bul. 32:183
Pachyscelus purpureus Say. Ent. Am. 5:32
Hadrobregmus errans Melsh. Am. Ent. Soc. Trans. 22:365
Trichodesma klagesi Fall. Am. Ent. Soc. Trans. 31:173
Heterachthes quadrimaculatus Newm. Pack. p. 293
Phyton pallidum Say. Ent. Soc. Wash. Proc. 3:97. Redbud
Molorchus bimaculatus Say. Pack. p. 293. Walnut, ash, maple, shad bush, dogwood
Stenosphenus notatus Oliv. Can. Ent. 20:66
Neoclytus scutellaris Oliv. Am. Ent. Soc. Trans. 22:368. Elm, grape
Neoclytus luscus Lec. N. Y. Ent. Soc. Jour. 4:77
Clytanthus ruricola Oliv. N. Y. Ent. Soc. Jour. 4:77
Clytanthus albofasciatus Lap. Pack. p. 292. Grape
Tillomorpha geminata Hald. Pack. p. 294. White oak
Centrodera picta Hald. Ins. N. J. p. 291
Goes oculata Lec., oak. N. Y. Ent. Soc. Jour. 4:78
Acanthoderes quadrigibbus Say, oak, beech, hackberry, box elder. Ent. Soc. Wash. Proc. 3:99
Leptostylus biustus Lec., orange. N. Y. Ent. Soc. Jour. 4:79
Liopus alpha Say var. cinereus Lec. Pack. p. 291. Locust
Liopus crassulus Lec. Am. Ent. Soc. Trans. 23:122
Lepturges facetus Say. Am. Ent. Soc. Trans. 22:369. Juniper
Ecyrus dasycerus Say. Pack. p. 292. Locust, tulip, redbud
Eupogonius vestitus Say. Pack. p. 292. Walnut, chestnut, dogwood
Dysphaga tenuipes Hald. Pack. p. 291. Oak, walnut, redbud
Auletes ater Lec. Am. Ent. Soc. Trans. 22:375. Sweet fern
Otidocephalus chevrolatii Horn., elm, hazel, grape. N. Y. Ent. Soc. Jour. 1:42
Otidocephalus myrmex Herbst., hazel, grape. N. Y. Ent. Soc. Jour. 1:42
Anthonomus suturalis Lec. Ent. Soc. Ont. 14th Rep't, p. 50
Conotrachelus elegans Say. N. Y. Ent. Soc. Jour. 1:82
Conotrachelus nenuphar Herbst. Pack.
Cryptorhynchus fallax Lec. N. Y. Ent. Soc. Jour. 1:83
Cryptorhynchus obliquus Say. N. Y. Ent. Soc. Jour. 1:83
Acoptus suturalis Lec. Pack. p. 297. Beech, hornbeam
Hypothenemus crudiae Panz., oak. Ins. N. J. p. 362
Hypothenemus dissimilis Zimm. Hopk. W. Va. Agric. Exp. Sta. Bul. 31:133
Xylocleptes decipiens Lec. Ent. Soc. Wash. Proc. 2:304
Micracis suturalis Lec., oak, black walnut, prickly ash, white ash, black locust, sassafras, willow, redbud. Ent. Soc. Wash. Proc. 2:394
Micracis aculeata Lec. Can. Ent. 23:65

Thysanoes fimbricornis Lec. Pack. p. 203
Acrobasis caryae Grote, greenish, brown spotted caterpillar, sparse white hairs, $\frac{1}{2}$ in., in twigs. Papilio, 1:13
Acrobasis angusella Grote, in leaf stem. Am. Ent. Soc. Trans. 17:121

HICKORY

Leaf feeders

Odontophyes aviingrata Dyar, solitary, footless, dung-mimicking larva; butternut. Psyche, 8:212
Isodyctium caryicolum Dyar, light green larva, dorsal line darker. N. Y. Ent. Soc. Jour. 6:135
Macrophya externa Say, sordid, pinkish, waxen larva with darker dorsal band. Dyar. Can. Ent. 30:173
Acordulecera dorsalis Say, colorless larva, head pale or black; oak. Dyar. N. Y. Ent. Soc. Jour. 5:109
Dichelonycha elongata Fabr., oak, beech, elm, hazel. Ent. Soc. Ont. 14th Rep't. p. 43. Willow, birch, alder, pine
Lachnosterna hirticula Knoch., bur oak. Ky. Agr. Exp. Sta. Bul. 120, p. 76
Bassareus mammifer Newm., hazel. Ins. N. J. p. 301
Tymnes violaceus Horn. Am. Ent. Soc. Trans. 22:370
Phyllotreta picta Say. Ins. N. J. p. 316
Eugnamptus collaris Fabr. N. Y. Ent. Soc. Jour. 1:36. Scrub oak, butternut
Rhynchites aeratus Say. Can. Ent. 23:21

Caterpillars

Apatela innotata Guen., gray, brown, yellow and black spotted. Sm. & Dyar. U. S. Nat. Mus. Proc. 21:74
Apatela funeralis Gr. & Rob., sooty black, white patches, $1\frac{3}{5}$ in.; elm, apple, birch. Sm. & Dyar. U. S. Nat. Mus. Proc. 21:102
Baileya dormitans Guen. Can. Ent. 23:35
Prodenia commelinae Abb. & Sm. Pack.
Mamestra detracta Walk., pale yellowish, marbled, red brown; oak bud feeder. Dyar. Ent. Soc. Wash. Proc. 4:310
Catocala angusi Grote. Pack. p. 305
Catocala judith Streck, greenish black, lighter reticulations, $1\frac{3}{4}$ in. Dodge. Can. Ent. 33:224
Catocala flebilis Grote, gray, green tinted, black dotted, white marked, $2\frac{1}{2}$ in. Kellicott. Papilio, 1:141
Catocala habilis Grote, dark or light striped, whitish ventrally, 2 in. Kellicott. Ent. Am. 2:46. Walnut
Catocala insolabilis Guen. Pack. p. 304
Catocala obscura Streck, dark gray, black marked, 2 in. Pack. p. 305
Catocala palaeogama Guen., reddish, dark striped, $2\frac{3}{4}$ in. French. Can. Ent. 20:108. Black walnut, chestnut
Catocala robinsonii Grote. Pack. p. 303
Catocala serena Edw. Pack. p. 303
Heterocampa subrotata Haw., green, black and brown marked, $2\frac{1}{2}$ in.; maple, witch-hazel, dogwood, birch. Dyar. Ent. Am. 6:209
Schizura leptinoides Grote, pale brown, darker mottled, tuberculate, $2\frac{1}{2}$ in. Dyar. Ent. Am. 6:230. Black walnut

Olene leucophaea Abb. & Sm., black headed, whitish, hairy; black hair tuft and pencils; oak. Dyar. Psyche, 7:135. Persimmon
Cochlidion y-inversa Pack., greenish slug caterpillar. Dyar & Morton. N. Y. Ent. Soc. Jour. 3:151–57. Blue beech
Tortricidia flexuosa Grote, yellowish and green slug caterpillar, dorsal mark variable, $^2/_5$ in.; oak, chestnut, hazel, wild cherry. Dyar. N. Y. Ent. Soc. Jour. 6:94
Exartema versicoloranum Clem. Pack. p. 313
Epagoge caryae Robs. Am. Ent. Soc. Trans. 10:21
Archips infumatana Zell. Am. Ent. Soc. Trans. 10:11
Eulia juglandana Fern. Am. Ent. Soc. Trans. 10:15. Walnut
Ypsolophus caryaefoliellus Chamb., red headed, green, white striped, $^3/_4$ in. Can. Ent. 4:224

Leaf miners

Coptodisca lucifluella Clem., brown headed, green, black spotted. Tineina N. A. p. 143
Gelechia caryaevorella Pack. Pack. p. 314
Coleophora caryaefoliella Clem., dark brown, cylindric case bearer; dogwood. Tineina N. A. p. 166
Nepticula caryaefoliella Clem., pale green with brownish head. Pack. p. 315
Lithocolletes caryaefoliella Clem., black or brownish. Pack. p. 334. Black walnut, butternut
Lithocolletes celtifoliella Chamb., yellowish larva; tent mine on under surface. Can. Ent. 3:129

Leaf sucking insects

Nezara pennsylvanica De Gr., green, black marked bug, $^3/_5$ in. Pack. p. 326
Cyrtolobus vau Say, butternut. Ent. Soc. Ont. 13th Rep't, p. 77
Telamona fasciata Fitch, yellowish, black marked tree hopper, $^4/_5$ in. Pack. p. 325
Ceresa brevicornis Fitch, yellowish, brown marked, horned tree hopper, $^1/_3$ in. Pack. p. 325
Microcentrus caryae Fitch, dull brown, yellowish tree hopper, $^1/_3$ in. Pack. p. 324
Cixius coloepium Fitch, black tree hopper, wings brown, banded, $^1/_5$ in. Pack. p. 326
Cixius cinctifrons Fitch, white, brown marked tree hopper, $^1/_5$ in. Pack. p. 325
Diedrocephala coccinea Forst., yellow leaf hopper, wings green, red striped, $^1/_3$ in. Pack. p. 324
Otiocerus amyotii Fitch, yellow, brown marked tree hopper, $^1/_4$ in. Pack. p. 326
Phlepsius irroratus Say, white, black marked leaf hopper, $^1/_4$ in. Pack. p. 324

Aphids

Monellia caryella Fitch, pale yellow. Pack. p. 323
Lachnus caryae Harr., black, bluish white, $^1/_4$ in. Pack. p. 299. Walnut
Schizoneura caryae Fitch, cottony aphids, $^1/_8$ in. Pack. p. 298. Black walnut
Callipterus caryae Mon. Ins. N. J. p. 104. Black walnut

Scale insects

Chionaspis caryae Cooley. Fern. Coccidae, p. 214
Aspidiotus uvae Comst., grapevine. Fern. Coccidae, p. 280
Eulecanium pyri Schr., white pine. Fern. Coccidae, p. 194
Eulecanium caryarum Ckll. Can. Ent. 30:293

Galls

Cecidomyia cynipsea O. S., round, hard, midrib gall, $^1/_2$ in. Diptera N. A. 1 : 193
Cecidomyia sanguinolenta O. S., conical, red, .15 in. high. Diptera N. A. 1 : 192
Cecidomyia cossae Shim. Cat. N. A. Diptera. p. 159
Cecidomyia nucicola O. S., larva in deformed husks. Am. Ent. Soc. Trans. 3 : 53
Cecidomyia caryae O. S., subglobular, seedlike, nippled, .05 to .10 in. Diptera N. A. 1 : 191
Cecidomyia glutinosa O. S., larvae beneath leaves, no gall. Diptera N. A. 1 : 193
Phylloxera conica Shim., depressed leaf gall. Pack. p. 323
Phylloxera caryaevenae Fitch, keellike plates in leaf veins. Pack. p. 322
Phylloxera caryae-semen Walsh, minute, subglobular galls. Pack. p. 322
Phylloxera caryae-ren Riley, reniform galls on petiole. Pack. p. 323
Phylloxera caryae-septum Shim. var. **perforans** Perg., single galls close to midrib. Perg. Davenport Acad. Sci. Proc. 9 : 193
Phylloxera caryae-fallax Walsh, conical, crowded on upper surface. Pack. p. 323
Phylloxera caryae-globuli Walsh, hemispheric, on upper surface, $^1/_4$ in. Pack. p. 322
Phylloxera caryae-gummosa Riley, stemmed, globular galls. Pack. p. 323
Phylloxera caryae-avellana Riley, yellowish or greenish, pink pubescent galls. Perg. Davenport Acad. Sci. Proc. 9 : 228
Phylloxera caryae-foliae Fitch. Davenport Acad. Sci. Proc. 9 : 194
Phylloxera deplanata Perg., reddish or greenish yellow, conical below. Davenport Acad. Sci. Proc. 9 : 205
Phylloxera depressa Shim., depressed, fringed leaf gall. Pack. p. 323
Phylloxera forcata Shim., minute, seedlike gall. Pack. p. 322
Phylloxera foveola Perg., red tinted, yellowish green, thin walled gall. Davenport Acad. Sci. Proc. 9 : 200
Phylloxera foveata Shim., resembles preceding. Davenport Acad. Sci. Proc. 9 : 209
Phylloxera globosum Shim., greenish, subglobose galls; under surface. Davenport Acad. Sci. Proc. 9 : 236b
Phylloxera intermedia Perg., intergrade of c-septum and picta. Davenport Acad. Sci. Proc. 9 : 199
Phylloxera picta Perg., smaller than c-septum; flattened. Davenport Acad. Sci. Proc. 9 : 197
Phylloxera pilosula Perg., pilose, light green, flattened above; convex, and with nipple below. Davenport Acad. Sci. Proc. 9 : 203
Phylloxera perniciosa Perg., conical galls; both surfaces. Davenport Acad. Sci. Proc. 9 : 251
Phylloxera rimosalis Perg., large yellowish gall; terminal leaves. Davenport Acad. Sci. Proc. 9 : 217
Phylloxera spinosa Shim., irregular, spinose galls on petiole. Pack. p. 322
Phylloxera spinuloida Perg., more globular than those of P. caryaecaulis Fitch, with numerous irregular, radiating, low ridges on petiole and midrib. Davenport Acad. Sci. Proc. 9 : 247
Phylloxera subelliptica Shim., elongate, nutlike petiole galls. Perg. Davenport Acad. Sci. Proc. 9 : 250
Phylloxera symmetrica Perg., flattened, greenish; on under surface. Davenport Acad. Sci. Proc. 9 : 230

SYCAMORE

Leaf feeders

Halisidota harrisii Walsh, yellow, haired larva with orange and white hair pencils Dyar. Psyche, 6:162
Misogada unicolor Pack., green, yellow lined, red marked, humped larva. Pack. Monogr. Bombycine Moths, p. 254. Maple.
Ancylis platanana Clem. Am. Ent. Soc. Trans. 10:50
Nepticula platanella Clem., pale green; blotched mine. Pack. p. 644
Nepticula clemensella Chamb. Pack.
Nepticula maximella Chamb. Pack.
Gelechia albisparsella Chamb. Pack.
Lachnus platanicola Riley. Pack.
Corythuca ciliata Say. Pack. Willow

BUTTONBUSH

Leaf feeders

Siobla excavata Nort., leaden black sawfly larva. Dyar. N. Y. Ent. Soc. Jour. 5:190
Centrinus lineicollis Lec. N. Y. Ent. Soc. Jour. 1:85
Ampelophaga versicolor Harr., yellowish green or green, white lined, horned larva, 2½ to 3 in. Hulst. Can. Ent. 10:64

WALNUT

Leaf feeders

Bassareus mammifer Newm., hickory. Am. Ent. Soc. Trans. 22:370. Locust
Anthonomus profundus Lec. Am. Ent. Soc. Trans. 22:376. Thorn
Catocala neogama Sm. & Abb., wood-brown, striped larva. Dodge. Can. Ent. 33:299
Catocala piatrix Grote, pale gray larva, 2 7/16 in. Dodge. Can. Ent. 33:299. Hickory, persimmon
Mineola juglandis Le B., dark green case bearer in leaflets. Pack. p. 311. Hickory

Scale insects

Eulecanium pruinosum Coq., ash, birch, laurel. Fern. Coccidae, p. 193
Aspidiotus juglans-regiae Comst., maple, locust, plum, cherry. Fern. Coccidae, p. 265
Eulecanium juglandis Bouché, plum. Fern. Coccidae, p. 189
Aulacaspis pentagona Targ. Fern. Coccidae, p. 234

BLACK WALNUT

Insects

Acrobasis demotella Grote, twig borer. Am. Ent. Soc. Trans. 17:122
Allorhina nitida Linn., greenish, stout beetle in bark. Pack. p. 320
Magdalis inconspicua Horn. Hopk. W. Va. Agric. Exp. Sta. Bul. 32:205

Leaf feeders

Attelabus analis Ill., black, red marked, leaf-rolling weevil, 1/4 in. Pack. p. 335. Sumac

Cressonia juglandis Abb. & Sm., bluish green, horned caterpillar. Pack. p. 330

Catocala subnata Grote. Pack. p. 333

Allotria elonympha Hübn., gray white with rose tints. Pack. p. 331. Tupelo

Bomolocha madefactalis Guen., slender, green, white, subdorsal striped larva. Dyar. Ent. Soc. Wash. Proc. 4: 329

Aplodes bistriaria Hübn., pale brown spanworm; two thoracic tubercles; four large flaps on median rings; one on end of body. Pack. Monogr. Geometrid Moths. p. 388

Coptodisca juglandiella Chamb., leaf miner. Pack. p. 335

Gracilaria juglandiella Chamb., mines under surface, then lives in curled part. Can. Ent. 4: 29

Gracilaria blandella Clem., black larva in serpentine mine on upper surface. Can. Ent. 5: 14

Nepticula juglandifoliella Clem., pale green dipteroid larva. Pack. p. 334

Gall mite

Acarus caulis Walsh, red or brown petiole or leaf vein gall. Ins. Galls of Ind. p. 859

BUTTERNUT

Pests

Eriocampa juglandis Fitch, woolly, greenish or gray larva. Dyar. N. Y. Ent. Soc. Jour. 5: 200

Eugnamptus angustatus Hbst. Pack.

Diacrisia virginica Fabr., stout, hairy, yellowish larva. Pack. p. 340. Oak

Carynota mera Say, greenish gray, subconical tree hopper, 1/3 in. Pack. p. 342

Corythuca arcuata Say, small lace bug, 1/8 in. Pack. p. 342

Eulecanium juglandifex Fitch, hemispheric, brown or black scale, 1/5 in. Pack. p. 338

CHESTNUT

Borers

Agrilus vittaticollis Rand., chokecherry, thorn, shadbush, mountain laurel. Ent. Am. 5: 32

Leptostylus collaris Hald. Ent. Soc. Wash. Proc. 3: 100

Distenia undata Oliv., hickory, hornbeam. N. Y. Ent. Soc. Jour. 4: 77

Liopus variegatus Hald. N. Y. Ent. Soc. Jour. 4: 79. Hackberry, maple, box elder, locust

Leptura cordifera Oliv. Psyche, 4: 204

Cryptorhynchus obtentus Hbst., hickory, maple. U. S. Div. Ent. Bul. 7, n. s. p. 71

Magdalis salicis Horn. N. Y. Ent. Soc. Jour. 1: 43. Butternut

Dryocoetes granicollis Lec. Ins. N. J. p. 363

Platypus compositus Say, black oak, sugar maple, basswood, magnolia, red elm, beech, wild cherry. W. Va. Agric. Exp. Sta. Bul. 31: 127

Platypus quadridentatus Oliv., pin holes; oak. W. Va. Agric. Exp. Sta. Bul. 31: 127

Xyleborus pubescens Zimm., white oak, jack oak, black oak, buckeye, magnolia, basswood, honey-locust. W. Va. Agric. Exp. Sta. Bul. 31: 137

Silvanus bidentatus Fabr., light brown, flat, $\frac{1}{10}$ in., under dead bark. Pack. p. 344. Elm
Hydnocera unifasciata Say. Ent. Am. 6: 155
Stenopsis argenteomaculatus Harr., large, naked caterpillar. Pack. p. 346. Oak, maple, willow, poplar, alder

Leaf feeders

Cercopeus chrysorhoeus Say. Ins. N. J. p. 341
Plocamus hispidulus Lec. U. S. Div. Ent. Bul. 7, n. s. p. 72. Locust
Apatela lithospila Grote, green, whitish frosted larva; oak, hickory. Sm. & Dyar. U. S. Nat. Mus. Proc. 21: 98
Deptalia insularia Guen. U. S. Div. Ent. Bul. 32: 55
Euchlaena obtusaria Hübn., slate-colored, marbled with livid, spanworm, 1$\frac{5}{8}$ in. Pack. p. 347
Tetracis crocallata Guen., brown, black marked spanworm, 1 in. Pack. p. 347. Sumac, spicebush
Abbotana clemataria Abb. & Sm., brown mottled, tuberculate spanworm, with lateral fingerlike processes on third segment. Dyar. Psyche, 9: 142. Elm, sassafras, willow
Eurycyttarus confederata Gr. & Rob. Pack.
Sisyrosea textula H.-S., green, yellow lined, red marked slug caterpillar, $\frac{2}{3}$ in.; oak, hickory, beech, hop-hornbeam, bayberry, elm, maple, linden, plum, cherry. Dyar. N. Y. Ent. Soc. Jour. 4: 185

Leaf miners

Nepticula castaneaefoliella Chamb., linear, crooked mine; upper surface. Cinn. Quar. Jour. Sci. 2: 117
Nepticula latifasciella Chamb. Pack. p. 340
Bucculatrix trifasciella Clem. Pack. p. 349
Lithocolletes castaneaeella Chamb., blister mine on upper surface; oak. Cinn. Quar. Jour. Sci. 2: 104
Tischeria castaneaeella Chamb., larger than T. zelleriella. Cinn. Qaar. Jour. Sci. 2: 111. Oak
Tischeria tinctoriella Chamb., white blotch mine; with short zigzag purple line, black oak. Cinn. Quar. Jour. Sci. 2: 108

Sucking insects

Atymna inornata Say, triangular, light green, yellowish tree hopper, $\frac{1}{4}$ in. Pack. p. 350
Atymna castanea Fitch, triangular, black, green marked tree hopper, $\frac{1}{4}$ in. Pack. p. 350
Callipterus castanea Fitch, yellowish, black marked aphid, $\frac{1}{10}$ in. Pack. p. 350

BEECH

Borers

Anamorphus pusillus Zimm., on beech fungi. Cinn. Soc. Nat. Hist. Jour. 20: 251
Tenebrioides corticalis Mels. Ent. Soc. Ont. 27th Rep't, p. 70
Rhizophagus dimidiatus Mann., under dead bark
Bostrichus bicornis Web., elm, apple. W. Va. Agric. Exp. Sta. Buf. 32: 180
Chrysobothris sexsignata Say, birch. U. S. Div. Ent. Bul. 7, n. s. p. 71. Pine

Eucrada humeralis Mels. Ent. Soc. Ont. 27th Rep't, p. 71
Corymbites cruciatus Linn. Ent. Soc. Ont. 27th Rep't, p. 70
Elater discoideus Fabr. Ins. N. J. p. 248
Perothops mucida Gyll. Ins. N. J. p. 252
Chalcophora campestris Say, sycamore, maple, tulip. Ins. N. J. p. 253
Platycerus quercus Web. Ent. Soc. Ont. 27th Rep't, p. 72
Platycerus depressus Lec. Ent. Soc. Ont. 27th Rep't, p. 72
Dryobius sexfasciatus Say. Pack.
Cyrtophorus verrucosus Oliv. N. Y. Ent. Soc. Jour. 4:77. Oak, linden, wild cherry
Hoplosia nubila Lec., basswood twigs. Am. Ent. Soc. Trans. 23:134
Toxotus schaumii Lec. Ent. Soc. Ont. 27th Rep't, p. 73
Lepturges signatus Lec., red bud. Ent. Soc. Wash. Proc. 3:101. Sumac
Xylotrechus quadrimaculatus Hald. Ent. Soc. Ont. 27th Rep't, p. 73. Black alder
Pelecotoma flavipes Mels. Ent. Soc. Ont. 27th Rep't, p. 74
Phloeophagus minor Horn. Pack.
Scolytus fagi Walsh. Pack. Hackberry
Xyleborus obesus Lec. Pack.
Euchaetes echidna Lec. N. Y. Ent. Soc. Jour. 1:85
Choragus sayi Lec. N. Y. Ent. Soc. Jour. 1:88

Leaf feeders

Hyperitis amicaria H.-S., brownish, white spotted larva, 1⅛ in. U. S. Div. Ent. Bul. 13:28. Oak, beech, hornbeam, alder
Isochaetes beutenmulleri Hy. Ed., pale green larva; oak. Dyar. N. Y. Ent. Soc. Jour. 7:208
Exartema fagigemmaeanum Chamb. Am. Ent. Soc. Trans. 10:29
Venusia comptaria Walk. Ent. Am. 3:50. Birch, alder

Sucking insect

Pemphigus imbricator Fitch, on underside of twigs. Am. Ent. Soc. Trans. 20:301

HOP-HORNBEAM

Leaf feeders

Pteronus ostryae Marlt., green larva, brown on folds. Dyar. N. Y. Ent. Soc. Jour. 5:26
Cecidomyia pudibunda O. S., larvae in red leaf fold. Diptera N. A. 1:202
Coptodisca ostryaefoliella Clem., leaf miner. Pack. p. 648
Coleophora ostryae Clem., brown, flattened case; parallel edges. Tineina N. A., p. 167
Nepticula ostryaefoliella Clem., narrow, contorted, frass-lined mine. Tineina N. A. p. 172
Nepticula virginiella Clem., slender, long mine; scattered frass particles. Tineina N. A. p. 172
Lithocolletes ostryaefoliella Clem., marginal mine becoming corrugated. Pack. p. 649
Lithocolletes tritaeniella Chamb. Pack.

Lithocolletes obscuricostella Clem. Tineina N. A. p. 71
Chrysopeleia ostryaeella Chamb. Pack.

HORNBEAM OR IRONWOOD

Leaf feeders

Pteronus carpini Marlt., dull green, yellow blotched larva. Dyar. N. Y. Ent. Soc. Jour. 6: 121
Psylla carpini Fitch. Pack.

HOP TREE

Leaf miner

Nepticula pteliaeella Chamb., blotch mine in very long, tortuous, linear mine. Psyche, 3: 137

HAZEL

Borers

Agrilus arcuatus Say var. coryli Horn. Am. Ent. Soc. Trans. 22: 364
Dichelonycha subvittata Lec. Am. Ent. Soc. Trans. 27: 282

Leaf feeders

Apatela falcula Grote, dark brown, green marked, spined larva, 1¼ in. Pack. p. 637
Exartema permundanum Clem., black headed, greenish larva, ⅔ in. Papilio, 3: 102
Exartema corylanum Fern. Pack.
Eulia ministrana Linn., green larva. Am. Ent. Soc. Trans. 10: 15
Lithocolletes corylisella Chamb., blotch mine; upper surface. Pack. p. 641. Hornbeam
Nepticula corylifoliella Clem., long, winding, narrow mine. Pack. p. 639
Coleophora corylifoliella Clem., case irregular, cylindric, compressed, toothed. Tineina N. A. p. 166
Anacampsis tristrigella Wlsm., pale greenish, black marked leaf roller, 9/16 in. Pack. p. 639
Ypsolophus trinotellus Coq., dark brown, white marked leaf roller, ¾ in. Pack. p. 640
Depressaria groteella Rob., green, dark marked leaf roller, ⅝ in. Pack. p. 639
Menesta tortriciformella Clem. Pack.

Affecting nuts

Balaninus obtusus Blanch. Pack.

WITCH HAZEL

Borers

Hydnocera longicollis Ziegl. Ent. Am. 6: 155
Mycetochares nigerrima Casey, under dead bark

Leaf feeders

Luperodes meraca Say. Ent. Soc. Wash. Proc. 2: 264
Scopelosoma moffatiana Grote, white, yellow banded larva, 1¼ in. Parsall. Ent. Am. 4: 59

Celama triquetrana Fitch, pale yellow larva, darker dorsally, ½ in. Dyar. Insect Life, 3:62
Exartema footianum Fern. Am. Ent. Soc. Trans. 10:31
Olethreutes niveiguttana Grote, sassafras. Am. Ent. Soc. Trans. 10:36
Gelechia hamameliella Clem., pale green leaf roller in tube. Pack. p. 668
Gracilaria alchimiella Scop., pale green leaf roller in cones. Pack. p. 668. Maple

LIQUIDAMBAR

Leaf feeders

Paectes delineata Guen., yellowish green, yellow marked, ⅞ in. Dyar. Can. Ent. 31:27
Paectes pygmaea Hübn., yellowish green, yellow marked, ⅔ in. Edw.-Elliott. Papilio, 3:135

ELM

Borers

Anthaxia viridicornis Say. Pack. p. 229. Hickory, willow
Eupogonius subarmatus Lec. Am. Ent. Soc. Trans. 22:369
Leptura emarginata Fabr., slippery elm. Psyche, 4:204
Trichodesma gibbosa Say. Am. Ent. Soc. Trans. 22:365

Leaf feeders

Monocesta coryli Say., hazel, red elm. Ent. Soc. Ont. 13th Rep't, p. 59
Cotalpa lanigera Linn., oak, hickory, poplar. Pack. p. 274
Haltica chalybea Ill. Pack. p. 237
Cryptocephalus quadruplex Newm. Ins. N. J. p. 302
Plocetes ulmi Lec. N. Y. Ent. Soc. Jour. 1:81

Caterpillars

Deilephila lineata Fabr., greenish, black and red, horned, 3 in. Pack. p. 271. Apple, plum, rose
Smerinthus jamaicensis Dru., bluish green, yellow lined, horned, 2 1/5 in.; oak, hazel, hornbeam, ash, apple, plum, cherry, willow, poplar, birch. Beut. N. Y. Ent. Soc. Jour. 9:89
Paonias excaecatus Abb. & Sm., green, yellow marked, horned, 2.21 in.; oak, hazel, ash, linden, apple, plum, cherry, willow, poplar, birch. Beut. Am. Mus. Nat. Hist. Bul. 7:314
Utetheisa bella Linn., deep buff, black marked, 1¼ in. Pack. p. 257
Apatela grisea Walk., green, brownish, humped, ⅗ in. Pack. p. 272. Apple, willow
Apatela interrupta Guen., purplish with long, reddish hairs, humped, 1 in.; oak, apple, birch. Sm. & Dyar. U. S. Nat. Mus. Proc. 21:79
Apatela morula Grote & Rob., greenish brown, humped, 2 in. Pack. p. 272. Linden
Apatela vinnula Grote, green, brown tubercles, 1 in. Sm. & Dyar. U. S. Nat. Mus. Proc. 21:93
Bomolocha abalienalis Walk., green, white striped; slippery elm. Dyar. Can. Ent. 23:157

Datana contracta Walk., black, yellow striped, 2¼ in. Pack. p. 266. Oak, hickory, chestnut
Nerice bidentata Walk., greenish, irregular, dorsal serrations, 1¼ in. Pack. Monogr. Bombycine Moths, p. 171
Heterocampa bilineata Pack., green, white and yellow lined, red marked, 1¼ in.; beech. Pack. Monogr. Bombycine Moths, p. 218
Opheroptera boreata Hübn., maple. Ent. Am. 3:49
Olene plagiata Walk. Pack. Linden
Euchoeca albifera Walk. Ins. N. J. p. 441
Mesoleuca intermediata Guen. Ins. N. J. p. 441
Percnoptilota fluviata Hübn. Ins. N. J. p. 441
Selidosema umbrosarium Guen., horsechestnut, hemlock. Ins. N. J. p. 447
Episimus argutanus Clem., witch-hazel, black thorn, sumac. Am. Ent. Soc. Trans. 10:45
Ennomos magnarius Guen., dark green, reddish mottled, 4⅓ in.; hickory, chestnut, maple, linden. Beut. N. Y. Ent. Soc. Jour. 3:137
Ennomos subsignarius Hübn., dull colored, ⅞ in.; hickory, chestnut, maple, linden. Pack. p. 232
Canarsia ulmiarrosorella Clem., green; on upper surface. Ky. Agric. Exp. Sta. Bul. 84, p. 72
Hulstea undulatella Clem. Am. Ent. Soc. Trans. 17:187
Lithocolletes argentinotella Clem. Ent. Soc. Wash. Proc. 5:190. Oak
Lithocolletes ulmella Chamb., irregular blotch mine in upper surface. Can. Ent. 3:149

Sucking insects, etc.

Typhlocyba tricincta Fitch, pale yellowish, dark banded leaf hopper. Pack. p. 281
Lachnus ulmi Linn. Pack.
Aspidiotus ulmi John., catalpa. Fern. Coccidae, p. 280
Eulecanium canadense Ckll., white oak, hickory, maple, peach. Fern. Coccidae, p. 182
Eulecanium caryae Fitch, hickory, red cherry, willow. Fern. Coccidae, p. 183
Eulecanium cockerelli Hunter, oak, walnut, pear, plum, peach, sweet fern. Fern. Coccidae, p. 185
Eriophyes ulmi Garm., small, slender gall, 1/10 in. Pack. p. 281

HACKBERRY

Borers

Agrilus fallax Say. W. Va. Agric. Exp. Sta. Bul. 32:184
Urographis triangulifer Hald. Pack. p. 610
Phloeotribus frontalis Oliv. Pack. Mulberry
Scolytus muticus Say. Pack.
Micracis rudis Lec. Pack.
Proteoteras aesculanum Riley. Pack. p. 609. Maple

Leaf feeders

Caterpillars

Chlorippe celtis Bd. & Lec., green, horns at both ends, 1 in. Pack. p. 602
Chlorippe clyton Bd. & Lec., greenish; foliate, cephalic spines, 1½ in. Pack. p. 604. Wild plum

Hypatus bachmani Kirt., green, yellow striped, 1 in. Beut. Am. Mus. Nat. Hist. Bul. 5 : 277
Sphinx drupiferarum Abb. & Sm., green and white, horned, 3.5 in. Beut. Am. Mus. Nat. Hist. Bul. 7 : 300
Apatela rubricoma Guen., greenish; blackish dorsal bands; 1 3/5 in. Sm. & Dyar. U. S. Nat. Mus. Proc. 21 : 42
Salebria celtidella Hulst., pale green, striped, 5/6 in.; in leaf fold. Beut. Can. Ent. 22 : 17
Megalopyge opercularis Abb. & Sm. Pack. p. 609

Leaf galls

Pachypsylla celtidis-asteriscus Riley, blisterlike gall; upper surface. Pack. p. 618
Pachypsylla celtidis-cucurbita Riley, greenish yellow, pyriform; under surface; 1/16 in. Pack. p. 621
Pachypsylla celtidis-gemma Riley, budlike twig gall. Pack. p. 618
Pachypsylla celtidis-globulus Riley, globular, pyriform; under surface; 1/16 in. Pack. p. 621
Pachypsylla celtidis-pubescens Riley, subglobular, hairy; under surface; 1/12 in. Pack. p. 620
Pachypsylla celtidis-vesiculum Riley, blisterlike; under surface. Pack. p. 618
Pachypsylla celtidis-umbilicus Riley, circular, buttonlike; green, woody, 1/5 in. Pack. p. 619
Pachypsylla venusta O. S., subglobular, on petiole. Pack. p. 617

MULBERRY

Borers

Hetoemis cinerea Oliv. N. Y. Ent. Soc. Jour. 4 : 78. Walnut
Dorcaschema wildii Uhler. N. Y. Ent. Soc. Jour. 4 : 78. Osage orange
Dorcaschema alternatum Say. N. Y. Ent. Soc. Jour. 4 : 78. Orange

OSAGE ORANGE

Insects

Hormiscus saltator Lec. N. Y. Ent. Soc. Jour. 1 : 87
Eulecanium macluratum Ckll. Can. Ent. 30 : 294

ASH

Borers

Tylonotus bimaculatus Hald. Pack. p. 543. Hickory, black walnut, tulip, birch
Gnathotricus asperulus Lec. Pack.

Leaf feeders

Monophadnus bardus Say, whitish, gray tinged. Dyar. Am. Ent. Soc. Trans. 22 : 308
Allantus annularis Nort., green, dark dorsal line. Osborn. Ent. Soc. Ont. 15th Rep't, p. 32
Thysanocnemus fraxini Lec. N. Y. Ent. Soc. Jour. 1 : 81
Psomus politus Csy., common on sprouts. Cinn. Soc. Nat. Hist. Jour. 20 : 256

Sphinx chersis Hübn., greenish, yellow marked, horned, $3\frac{1}{4}$ in. Pack. p. 546. Lilac
Sphinx gordius Syoll., green, carmine striped, $2\frac{3}{5}$ in.; apple, huckleberry, myrica. Beut. N. Y. Ent. Soc. Jour. 9:87
Chlaenogramma jasminearum Boisd., green, six oblique white stripes, 3 in. Beut. Am. Mus. Nat. Hist. Bul. 7:300
Diacrisia latipennis Stretch, dark brown larva. Dyar. Ent. News, 2:115
Apatelodes angelica Grote, gray, black lined larva; lilac. Pack. Monogr. Bombycine Moths, p. 103
Coriscium cuculipennellum Hübn., yellowish green miner in leafy cone. Ent. News, 6:109. Privet

Sucking insects

Neoforus petitii Uhler. Pack.
Pemphigus fraxinifolii Riley, green and black aphid, $\frac{1}{16}$ in. Pack. p. 552
Trionymus americanus Ckll. Fern. Coccidae, p. 90

MAPLE

Borers

Oryssus sayi Westw., black, white marked, wasplike. Pack. p. 383
Oryssus terminalis Newm. Pack. p. 383
Acamptus rigidus Lec., soft maple. N. Y. Ent. Soc. Jour. 4:122
Leptura proxima Say. Can. Ent. 29:192
Pyrochroa femoralis Lec. Ent. Soc. Ont. 17th Rep't, p. 32
Enchodes sericea Hald. Ent. Soc. Ont. 17th Rep't, p. 32

Leaf feeders

Platycerus quercus Web., bud eater. Pack. p. 392

Caterpillars

Cyaniris ladon Cram., green and brown. French. Butt. East. U. S. p. 291. Wild cherry, dogwood, viburnum
Philosamia cynthia Drury, green, blue and yellow tubercled; $2\frac{1}{2}$ in.; general feeder. Beut. Ent. Am. 6:216
Apatela retardata Walk., whitish, red banded. Sm. & Dyar. U. S. Nat. Mus. Proc. 21:145
Noctua c-nigrum Linn. Pack.
Morrisonia confusa Hübn., white, crimson spotted; oak, hickory, apple, willow, birch. Dyar. Insect Life, 3:63
Bomolocha baltimoralis Guen., pale green, $\frac{7}{8}$ in. Pack. p. 407
Heterocampa biundata Walk., green, brown marked, $1\frac{1}{2}$ in.; hickory, beech, witch-hazel, cherry, dogwood, willow, birch. Pack. Monogr. Bombycine Moths, p. 235
Heterocampa guttivitta Walk., green, yellow and purple marked, $1\frac{1}{2}$ in.; oak, chestnut, beech, apple, viburnum. Pack. Monogr. Bombycine Moths, p. 230
Tolype velleda Stoll., bluish gray, white lined, $2\frac{1}{2}$ in., lateral haired tufts, $2\frac{1}{2}$ in.; oak, elm, cherry, lilac. Pack. p. 165
Heterophleps triguttaria H.-S., bluish green, light lined spanworm. Pack. Monogr. Geometrid Moths, p. 194

Psysostegania pustularia Guen., bluish green, light striped spanworm, ½ in. Harrington. Ent. Soc. Ont. 17th Rep't, p. 27
Lycia cognataria Guen., brown, black specked spanworm, 1½ in. Pack. p. 638. Elm, hazel, honey-locust, willow, larch
Eutrapela alciphearia Walk., brown, gray marked, angulate spanworm. Psyche, 8:395
Eutrapela kentaria Grote, oak, beech, linden, birch. Pack. p. 405
Euchlaena serrata Dru., brown mottled, black marked, spined spanworm. Psyche, 9:130
Phigalia titea Cram., elm, birch. Ent. Am. 3:49
Anagoga pulveraria Linn., gray, black marked, humped spanworm. Pack. p. 638. Beech, hazel, willow
Azelina ancetaria Hübn. Ent. Am. 3:47. Cherry
Sisyrosea inornata Gr. & Rob., elliptic, flattened, green, red and yellow slug caterpillar; hickory, wild cherry. Dyar. Can. Ent. 21:77
Lithacodes fasciola H.-S., yellowish green, white slug caterpillar, ½ in.; oak, hickory, chestnut, beech, hop-hornbeam, linden, cherry, dogwood, birch. Dyar. N. Y. Ent. Soc. Jour. 5:1
Platynota flavedana Clem., sassafras, rose. Am. Ent. Soc. Trans. 10:22
Pandemis lamprosana Rob. Pack. p. 408
Lithocolletes aceriella Clem., brown headed, yellowish miner. Pack. p. 409
Lithocolletes clemensella Chamb., mine and larva closely resembles that of L. lucidicostella Clem. Can. Ent. 11:91
Lithocolletes lucidicostella Clem., brown headed, pale green miner. Pack. p. 410
Incurvaria acerifoliella Fitch, round holes in leaves. Fitch. 2d Rep't, p. 269

Leaf mutilators

Megachile optiva Cress., leaf cutter. Pack. p. 410
Cecidomyia aceris Shim., larvae in curled, contorted leaves. Am. Ent. Soc. Trans. 1:281

Sucking insects

Lygus monachus Uhler. Pack. p. 420. Alder
Poecilocapsus goniphorus Say. Pack.
Psylla annulata Fitch. Ent. Soc. Ont. 17th Rep't, p. 33
Pemphigus aceris Mon., aphid on underside of limbs. Can. Ent. 14:16
Aleurodes aceris Forbes, white, chocolate marked, 9/10 in. Pack. p. 422
Aspidiotus comstockii John. Fern. Coccidae, p. 254
Aspidiotus rapax Comst., walnut, willow, birch, cottonwood. Fern. Coccidae, p. 276
Eulecanium cerasifex Fitch, oak, ash, apple, pear, plum, cherry, peach. Fern. Coccidae, p. 184
Chrysomphalus tenebricosus Comst. Fern. Coccidae, p. 294

BOX ELDER

Insects

Xylina grotei Riley. Pack.
Gracilaria negundella Chamb., leaf roller. Psyche, 3:66
Cecidomyia negundinis Gill., terminal bud gall. Psyche, 5:392

Chaitophorus negundinis Thom. Ins. N. J. p. 104
Pulvinaria acericola Walsh & Riley. Pack.

BURNING BUSH

Insect

Aphis rumicis Linn. Am. Ent. Soc. Trans. 20: 298. Euonymus

PRICKLY ASH

Insects

Liopus fascicularis Harr. Pack. p. 659
Catapastus conspersus Lec. Cinn. Soc. Nat. Hist. Jour. 20: 255
Papilio thoas Linn. Cram., dark brown, white banded caterpillar, 2 in.; orange, poplar, hop tree. Beut. Am. Mus. Nat. Hist. Bul. 5: 245

HONEY-LOCUST

Bark beetle

Ptinidium lineatum Lec., under decaying bark. Cinn. Soc. Nat. Hist. Jour. 20: 251

Leaf feeders

Caterpillars

Schizura ipomoeae Dougl., brown, green and white marked, humped, 1½ in. Pack. Mem. Bombycine Moths, p. 194
Heteropacha rileyana Harv. Pack.
Tlascala reductella Walk., greenish yellow, brown, yellow marked leaf roller, ⅝ in. Pack. p. 652
Catocala innubens Guen., dull white, obscurely striped, 2¼ in. French. Can. Ent. 20: 170. Black walnut
Catocala illecta Walk., black and white banded, 2 in. Beut. N. Y. Ent. Soc. Jour. 9: 189
Catocala minuta Edw., brownish, light striped; broad, white patches, 1¾ in. Dodge. Can. Ent. 33: 222
Adelocephala bicolor Harr., yellow, carmine, white and blue banded, 1 in.; coffee tree. Pack. Mem. Nat. Acad. Sci. 9: 65
Mompha gleditschiaeella Chamb. Psyche, 3: 66
Agnippe biscolorella Chamb. Pack.
Helice pallidochrella Chamb. Pack.

Leaf gall

Cecidomyia gleditschiae O. S., larvae in folded leaflets. Ins. Galls of Ind. p. 839

Scale insect

Aspidiotus ancylus Putn. Psyche, 9: 403

LOCUST OR BLACK LOCUST

Borers

Agrilus egenus Gory. W. Va. Agric. Exp. Sta. Bul. 32: 184
Agrilus otiosus Say. Pack. p. 367
Agrilus politus Say. Psyche, 4: 203. Willow

Ino reclusa Lec. Ent. Soc. Wash. Proc. 2:73
Liopus variegatus Hald., under bark (Joutel)
Liopus fascicularis Harr., prickly ash. N. Y. Ent. Soc. Jour. 4:79

Leaf feeders

Pteronus trilineatus Nort., brown headed, green sawfly larva, $^2/_5$ in. Pack. p. 369. Willow
Pachybrachys atomarius Melsh. W. Va. Agric. Exp. Sta. Bul. 32:199
Myochrous denticollis Say. W. Va. Agric. Exp. Sta. Bul. 32:199
Colaspis brunnea Fabr. Hopk. W. Va. Agric. Exp. Sta. Bul. 32:199
Nodonota tristis Oliv. Hopk. W. Va. Agric. Exp. Sta. Bul. 32:200
Nodonota puncticollis Say, sumac. Hopk. W. Va. Agric. Exp. Sta. Bul. 32:200
Phyllechthrus gentilis Lec. Hopk. W. Va. Agric. Exp. Sta. Bul. 32:201
Crepidodera aesculi Dury, buckeye. Cinn. Soc. Nat. Hist. Jour. 20:253
Coptocycla significa Hbst. W. Va. Agric. Exp. Sta. Bul. 32:202
Apion nigrum Hbst. N. Y. Ent. Soc. Jour. 1:40
Apion rostrum Say. Pack. p. 367. Sweet fern
Copturus binotatus Lec., oak, sumac. N. Y. Ent. Soc. Jour. 1:83
Anthribus cornutus Say. N. Y. Ent. Soc. Jour. 1:88
Cecidomyia robiniae Hald., whitish maggot in folded leaflets. Pack. p. 368
Dasyneura pseudacaciae Fitch, whitish maggots in leaflets. Pack. p. 368
Macrobasis unicolor Kirby. Pack. p. 371
Ptosima gibbicollis Say. Ins. N. J. p. 256. Redbud
Anomoea laticlavia Forst. Ent. Soc. Wash. Proc. 2:262
Euparthenos nubilis Hübn., brown, dark spotted larva. Pack. p. 370
Dasylophia anguina Abb. & Sm., red headed, lilac, yellowish and black lined larva; black tipped tubercle on eighth abdominal segment, 2 in. Pack. Monogr. Bombycinė Moths, p. 174
Sciagraphia heliothidata Guen., green, white lined spanworm. Dyar. Psyche, 9:203
Salebria contatella Grote, pale green, striped, $^2/_3$ in. Beut. Can. Ent. 22:16
Epagoge sulfureana Clem., yellowish green larva, $^5/_8$ in. Pack. p. 362. Willow, pine
Gelechia pseudoacaciella Chamb., green larva with reddish head, $^3/_5$ in. Pack. p. 363
Depressaria robiniella Pack., green, black headed. Pack. p. 364
Chrysopeleia purpuriella Chamb. Psyche, 3:64
Gracilaria lespedezaefoliella Clem., yellow blotch mine, upper surface. Cotton. Ohio Dep't Agric. Bul. 7, p. 37
Recurvaria robiniella Fitch, pale green, whitish or yellowish. Fitch. 5th Rep't, p. 55
Lithocolletes robiniella Clem., white blister mine, under surface. Fitch. 5th Rep't, p. 56
Lithocolletes morrisella Fitch. 5th Rep't, p. 58
Lithocolletes ostensackenella Fitch. 5th Rep't, p. 58
Lithocolletes uhlerella Fitch. 5th Rep't, p. 58
Xylestia pruniramiella Clem. Pack.
Spermophagus robiniae Sch. Pack.

REDBUD

Insects

Rhopalophora longipes Say. Ent. Soc. Wash. Proc. 3:97
Bruchus mimus Say. Psyche, 4:204

BASSWOOD OR LINDEN

Bark insects

Silvanus planatus Germ. Can. Ent. 18:66
Tenebrioides americana Kirby. Can. Ent. 18:66
Tetratoma truncorum Lec. Can. Ent. 18:67
Xyletinus lugubris Lec. Ent. Soc. Ont. 34th Rep't, p. 61
Orchesia castanea Melsh. Can. Ent. 18:67. Birch fungi
Eustrophus bicolor Say. Can. Ent. 18:67
Allandrus bifasciatus Lec. Ins. N. J. p. 366

Leaf feeders

Monophadnus tiliae Nort. Ent. Soc. Ont. 34th Rep't, p. 59
Chrysomela pnirsa Stal. Ent. Soc. Ont. 34th Rep't, p. 52
Odontota quadrata Fabr., oak, hornbeam, cherry, juneberry, white birch. Beut. Ent. Am. 6:178
Rhabdopterus picipes Oliv. Ins. N. J. p. 305
Ellida caniplaga Walk., whitish green, yellow lined, $\frac{1}{5}$ in. Dyar. N. Y. Ent. Soc. Jour. 10:143
Xylina bethunei Gr. & Rob. Ent. Soc. Ont. 34th Rep't, p. 54
Catocala cerogama Guen., ash-gray, black specked. Dyar. Can. Ent. 26:21
Erannis tiliaria Harr., yellow, black marked spanworm. Pack. p. 475. Oak, hickory, elm, apple, pear
Pantographa limata Gr. & Rob., green, brown spotted leaf roller, 1 in. Pack. p. 477
Coleophora tiliaefoliella Clem., dark brown larva; pistol-shaped case. Pack. p. 478
Lithocolletes lucetiella Clem., greenish, brown headed leaf miner. Pack. p. 478
Lithocolletes tiliacella Chamb. Ent. Soc. Ont. 34th Rep't, p. 58

Galls

Cecidomyia citrina O. S., young terminal buds deformed. Pack.
Sciara tilicola O. S., pealike swelling on stem near origin of last two leaves. Pack.

Sucking insects

Gargaphia tiliae Walsh. Pack.
Drepanosiphum tiliae Koch. Pack.
Lachnus longistigma Mon. Pack.
Aspidiotus diffinis Newst., lilac. Fern. Coccidae, p. 257
Pulvinaria tiliae Kg. & Ckll., woolly bark louse. Psyche, 8:286

TULIP TREE

Borers

Acanthoderes morrisii Uhler. N. Y. Ent. Soc. Jour. 4:78. Sour gum
Himatium conicum Lec. N. Y. Ent. Soc. Jour. 1:87

Leaf insects

Cecidomyia liriodendri O. S., brown spots with yellow or greenish aureole. Diptera N. A. 1:202
Cecidomyia tulipiferae O. S., midrib swelling of leaf. Diptera N. A. 1:202
Callosamia angulifera Walk., greenish, black marked, red and yellow tubercled larva, 2½ in.; sassafras, wild cherry. Beut. Ent. Am. 5:200
Polychrosis botrana Schiff., greenish or purplish, naked larva, ⅜ in. Am. Ent. Soc. Trans. 10:28
Phyllocnistis liriodendronella Clem., broad, very long, linear, contorted mine; underside; brownish frass line. Tineina N. A. p. 220

Tulip aphid

Nectarophora liriodendri Mon. Pack.

SASSAFRAS

Borers

Oberea ruficollis Fabr., girdler. Can. Ent. 28:247. Sumac
Corthylus punctatissimus Zimm. W. Va. Agric. Exp. Sta. Bul. 31:127

Leaf feeders

Prionomerus calceatus Say, larval leaf miner. Ins. N. J. p. 350
Papilio troilus Linn., green, blue spotted, yellow banded larva, 1¾ in.; spicebush. Beut. Am. Mus. Nat. Hist. Bul. 5:243. Wild plum
Gonodontis hypochraria H.-S., rust-red, black lined larva. Dyar. Ent. News, 5:61. Persimmon
Gracilaria sassafrasella Chamb. Ins. N. J. p. 481

Scale insect

Eulecanium lintneri Ckll. & Benn. Fern. Coccidae, p. 189

PLUM, WILD

Leaf feeders

Pteronus thoracicus Harr., whitish green, banded larva. Dyar. Am. Ent. Soc. Trans. 22:307
Incisalia irus Godt., slug-shaped, yellowish green and reddish brown lined larva, ½ in.; huckleberry. Beut. Am. Mus. Nat. Hist. 5:280

Sucking insects

Pediopsis trimaculata Fitch. Ent. Am. 5:172
Aphis cerasicolens Fitch. Pack.
Aphis cerasifoliae Fitch. Pack.

CHERRY, WILD

Borers

Sanninoidea exitiosa Say, white, naked caterpillar at base of trunk. Pack. p. 521

Leaf feeders

Lyda fasciata Nort., yellowish, black tipped [illegible]. Pack. p. 524
Eriocampoides limacina Retz., slug-like, slimy larva. Harrington. Ent. Soc. Ont. 15th Rep't, p. 60
Pseudanthonomus crataegi Walsh, wild thorn. Am. Ent. Soc. Trans. 22: 376
Galerucella rufosanguinea Say. Pack. p. 520
Epicaerus imbricatus Say. N. Y. Ent. Soc. Jour. 1: 38
Rhyncolus brunneus Mann. Pack.
Phloeophagus apionides Horn. N. Y. Ent. Soc. Jour. 1: 87. Birch.
Paonias myops Abb. & Sm., green, yellow marked, horned larva. Psyche, 5: 2[illegible]. Wild plum, thorn
Strymon titus Fabr., slug-like, dull green, pink or rose patched larva. Ag. Col. plum. Beut. Am. Mus. Nat. Hist. Bul. 5: 281
Chamyris cerintha Treits., purplish, white lined larva. Dyar. Psyche, 8: 340
Apatela furcifera Guen., black, red striped larva. Sm. & Dyar. U. S. Nat. Mus. Proc. 21: 85
Apatela radcliffei Harv., black, yellowish lined larva. Sm. & Dyar. U. S. Nat. Mus. Proc. 21: 107
Plagodis phlogosaria Guen. Ent. Am. 3: 28
Cymatophora pustularia Hubn., reddish, white lined, black dotted spanworm. Fm. Kellicott. Can. Ent. 17: 32
Synelys ennucleata Guen., brown, black marked spanworm: multiannulate segments. Dyar. Psyche, 9: 105
Tortrix pallorana Robs. Am. Ent. Soc. Trans. 10: 17
Alceris logiana Schiff. Pack.
Mineola indigenella Zell., brown or green larvæ: apple, crab apple, quince, plum, peach. Hulst. Am. Ent. Soc. Trans. 17: 139
Coleophora pruniella Clem., case flattened, deeply notched distally. Pack. p. 528
Nepticula prunifoliella Clem. Pack. p. 527
Nepticula serotinaeella Chamb., mine narrow, linear, much convoluted, filled with frass. Can. Ent. 5: 120

Gall insects

Cecidomyia serotinae O. S., enlarged terminal buds on young shoots. Am. Ent. Soc. Trans. 3: 340
Acarus serotinae Beut., pouch-like galls on upper surface, $\frac{1}{8}$ in. Ins. Galls of Ind. p. 858

MOUNTAIN ASH

Insects

Euzophera semifuneralis Walk., mining under bars. Kellicott. Can. Ent. 23: 250
Apatela clarescens Guen., green or greenish brown, reddish purple striped caterpillar: apple, wild cherry. Sm. & Dyar. U. S. Nat. Mus. Proc. 21: 123
Venusia cambrica Curtis, spanworm. Pack. Monogr. Geometrid Moths, p. 89

SHADBUSH OR JUNEBERRY (AMELANCHIER)

Leaf feeders

Schizocerus prunivorus Marlt., green larva, blotched with yellow subventrally; wild cherry. Dyar. N. Y. Ent. Soc. Jour. 5:23
Nyctobia limitata Walk. Ent. Am. 3:49
Ornix quadripunctella Clem., greenish, black dotted larva in mine on upper surface. Tineina N. A. p. 177
Nepticula amelanchierella Clem., broad, contorted, irregular mine with broad, frass line. Tineina N. A. p. 174

Scale insect

Eulecanium kansasense Hunter, redbud. Fern. Coccidae, p. 189

WILD THORN

Borers

Saperda cretata Newm. N. Y. State Mus. Bul. 74, p. 50
Xylotrechus convergens Lec. N. Y. Ent. Soc. Jour. 4:76

Fruit insects

Tachypterus quadrigibbus Say. Am. Ent. Soc. Trans. 22:376
Conotrachelus crataegi Walsh. Am. Ent. Soc. Trans. 22:376
Conotrachelus naso Lec. Pack.
Conotrachelus posticatus Boh. N. Y. Ent. Soc. Jour. 1:82

Leaf feeders

Anthonomus decipiens Lec. N. Y. Ent. Soc. Jour. 1:80
Nothus varians Oliv. Am. Ent. Soc. Trans. 22:373
Tymnes metasternalis Cr. Ins. N. J. p. 305
Stethobaris tubulatus Say. Am. Ent. Soc. Trans. 22:377
Limnobaris calva Lec. Am. Ent. Soc. Trans. 22:377
Anthonomopsis mixtus Lec. Am. Ent. Soc. Trans. 22:376
Apion herculaneum Smith. N. Y. Ent. Soc. Jour. 1:39
Catocala polygama Guen. var. **crataegi** Saund., gray-black, red marked larva, 1½ in. Pack. p. 532
Nacophora quernaria Abb. & Sm., slate-gray spanworm with tubercle on third thoracic and seventh abdominal segments. Pack. Monogr. Geometrid Moths, p. 412
Uranotes melinus Hübn. Pack.
Enarmonia prunivora Walsh. Pack.
Coptodisca splendoriferella Clem., linear, frass-lined mine, expanding to a small transparent blotch. Tineina N. A. p. 105. Wild cherry.
Nepticula crataegifoliella Clem., thick, bright green larva. Pack. p. 534
Ornix inusitatumella Chamb., nearly circular, blister mine on upper surface. Can. Ent. 5:48
Ornix crataegifoliella Clem., brownish, greenish white leaf miner. Pack. p. 534
Tischeria malifoliella Clem., brown, trumpet-shaped mine, upper surface. Pack.

Leaf gall

Cecidomyia bedeguar Walsh., subglobular, midrib gall, ½ in. Can. Ent. 1:79

Sucking insects

Melinna pumila Uhler, willow. Ent. Am. 3:60
Nectarophora crataegi Monell. Pack.
Schizoneura crataegi Oest. Pack.
Phenacoccus dearnessi King. Fern. Coccidae, p. 91
Chionaspis furfura Fitch var. fulva King, scurfy white scale. King. Psyche, 8:334

PERSIMMON

Insects

Olethreutes malachitana Zell. Am. Ent. Soc. Trans. 10:33
Artace punctistriga Walk. Can. Ent. 23:35
Brachystylus acutus Say. Ins. N. J. p. 341
Aphis diospyri Thom. Ins. N. J. p. 103

PAWPAW

Leaf feeder

Iphidicles ajax Linn., gray or green larva; white, black and yellow bands. French Butterflies East. U. S. p. 84

TREE OF HEAVEN

Leaf feeders

Atteva aurea Fitch, dark olive-brown, white lined larva, 7/8 in. Riley. 1st Mo. Rep't, p. 151

SWEET GUM

Leaf miner

Phyllocnistis liquidambarisella Chamb., indistinct, long, tortuous mine on upper surface. Cinn. Quar. Jour. Sci. Proc. 2:106

SOUR GUM OR PEPPERIDGE TREE INSECTS

Callichroma splendidum Lec. Can. Ent. 24:38
Nepticula nyssaeella Clem. Pack.
Phylloxera nyssae Perg., woolly aphid in bark crevices. Davenport. Acad. Sci. Proc. 9:269

CATALPA

Leaf feeders

Ceratomia catalpae Bois., black dorsal band, black and yellow lined larva, 3 in. Koebele. Bklyn Ent. Soc. Bul. 4:20
Cecidomyia catalpae Comst., abnormally brown maggoty pods. Pack. p. 669

ROSE

Leaf feeders

Emphytus cinctus L., banded, curled larva. Riley. Insect Life, 5:9
Cladius pectinicornis Fourcr., greenish, bristly larva. Riley. Insect Life, 5:9
Monostegia rosae Harr., greenish, sluglike larva, 1/2 in. Insect Life, 5:10
Trichius piger Fabr. U. S. Div. Ent. Bul. 27, n. s. p. 100
Nodonota puncticollis Say. U. S. Div. Ent. Bul. 7, n. s. p. 60

Deilephila galii Rott., dark green, yellow spotted larva, 3 in. Beut. Am. Mus. Nat. Hist. Bul. 7 : 286
Schizura mustelina Pack., dark brown, gray mottled and green larva, 4/5 in. French Can. Ent. 18 : 92
Chloridea virescens Fabr., Olive-green, yellow lined, 1/8 in. U. S. Div. Ent. Bul. 27, n. s. p. 101
Nepticula rosaefoliella Clem., mine very serpentine, frequently marginal, moderately broad, filled with black frass. Tineina N. A. p. 176
Coleophora rosaefoliella Clem., brown, cylindric, hooked case. Tineina N. A. p. 251
Coleophora rosacella Clem., dark red, compressed, cylindric, serrate case. Tineina N. A. p. 251

Rose scale

Eulecanium rosae King. Fern. Coccidae, p. 196

Rose galls

Rhodites multispinosa Gill., reddish brown, spined, knotlike excrescence on young shoots. Ent. Am. 6 : 25
Rhodites lenticularis Bass., lentil-shaped leaf gall on both surfaces, 1/10 in. Am. Ent. Soc. Trans. 17 : 59
Rhodites nebulosus Bass., globular, hollow leaf gall, 3/16 in., on under surface. Am. Ent. Soc. Trans. 17 : 63
Periclistis sylvestris O. S., guest fly from gall of Rhodites radicum. Ent. Soc. Phila. Proc. 4 : 366
Periclistis semipiceus Harr., guest in rose root gall. Ins. Inj. Veg. p. 436

DOGWOOD

Borers

Agrilus lecontei Saund. Psyche, 4 : 203
Psenocerus supernotatus Say. N. Y. Ent. Soc. Jour. 4 : 78
Anthonomus corvulus Lec. N. Y. Ent. Soc. Jour. 1 : 81

Leaf feeders

Harpiphorus versicolor Nort., shining, blue-gray larva, marked with leaden black. Dyar. N. Y. Ent. Soc. Jour. 5 : 22
Harpiphorus tarsatus Say, olivaceous black larva, 1 in. Dyar. N. Y. Ent. Soc. Jour. 5 : 21
Euthyatira pudens Guen., semitransparent, whitish flecked caterpillar. Dyar. Can. Ent. 21 : 209
Ancylis cornifoliana Riley. Am. Ent. Soc. Trans. 10 : 51
Antispila cornifoliella Clem., fat, white larva living first in linear, then a blotch mine. Psyche, 3 : 149

Gall

Cecidomyia clavula Beut., capitate, apical twig gall. Ins. Galls Ind. p. 841

Sucking insects

Eulecanium tarsale Sign. Fern. Coccidae, p. 197
Chionaspis corni Cooley. Fern. Coccidae, p. 215

Aphis cornifoliae Fitch. Am. Ent. Soc. Trans. 20:299
Schizoneura corni Fabr. Ins. N. J. p. 105

SUMAC

Borers

Pogonocherus penicellatus Lec. W. Va. Agric. Exp. Sta. Bul. 32:197
Cryptorhynchus obliquus Say, bores sumac roots. W. Va. Agric. Exp. Sta. Bul. 32:206
Pityophthorus consimilis Lec. W. Va. Agric. Exp. Sta. Bul. 31:130

Leaf feeders

Coscinoptera dominicana Fabr., oak, sassafras, apple, plum. Ent. Am. 6:175
Orthaltica copalina Fabr. Lint. 5th Rep't, p. 271
Blepharida rhois Forst. Ent. Am. 6:177
Pyrrhia umbra var. exprimens Walk., locust. Can. Ent. 23:36
Marasmalus inficita Walk. Can. Ent. 23:36
Marasmalus ventilator Grote. Can. Ent. 23:36
Datana perspicua Gr. & Rob., black headed, yellow, red striped larva, 1½ in. Pack. Monogr. Bombycine Moths, p. 117
Amorbia humerosana Clem. Am. Ent. Soc. Trans. 10:19. Pine, spicebush
Schreckensteinia erythriella Clem., dark green, deeply incised larva; middle of segments produced dorsally. Tineina N. A. p. 132

Sucking insects

Pulvinaria maclurae Kenn., osage orange. Fern. Coccidae, p. 135
Calophya nigripennis Riley. Ent. Soc. Wash. Proc. 6:244

ELDER

Insects

Tenthredo atroviolacea Nort., dark slaty, blue-black, shining larva. Dyar. N. Y. Ent. Soc. Jour. 5:192
Macrophya trisyllaba Say, black mottled, white larva. Dyar. N. Y. Ent. Soc. Jour. 5:192
Desmocerus palliatus Forst. N. Y. Ent. Soc. Jour. 4:77

LILAC

Leaf feeders

Phlegethontius rustica Fabr., dark green, blue banded, 4 in. Beut. Am. Mus. Nat. Hist. Bul. 7:300. Fringe tree
Harrisimemna trisignata Walk., black headed, yellow, brown and black marked, humped, 1¾ in. Goodhue. Can. Ent. 18:58. Honeysuckle, holly

PRIVET

Leaf feeder

Diaphania quadristigmalis Guen., pale yellow to bluish green larva, ¾ in. Insect Life. 1:22

FRINGE TREE

Leaf feeder

Periclista chionanthi Murtfeldt (M. S.), yellowish larva; broken subdorsal black shade. Dyar. N. Y. Ent. Soc. Jour. 6: 132

VIBURNUM

Leaf feeders

Macrophya bilineata MacGill., whitish translucent; body segments seven-annulated with minute black setae on second and fourth annulets. Dyar. N. Y. Ent. Soc. Jour. 5: 19

Macrophya mixta MacGill., head reddish, body waxy greenish. Dyar. N. Y. Ent. Soc. Jour. 5: 19

Hemaris thysbe Fabr., whitish green, yellow and white spotted larva, 1¾ in.; honeysuckle, snowberry. Beut. Am. Mus. Nat. Hist. Bul. 7: 277. Plum, thorn

Ampelophaga choerilus Cramer, pale green, dark lined larva, white marked, ⅕ in. Beut. Am. Mus. Nat. Hist. Bul. 7: 291. Sour gum

Diphthera fallax H.-S., flat, velvety green larva with narrow, dorsal and subdorsal pale lines. Dyar. N. Y. Ent. Soc. Jour. 7: 67

Schizura badia Pack., green, brown and yellow marked larva, 1½ in. Pack. Monogr. Bombycine Moths, p. 208

Calledapteryx dryopterata Gr., translucent white larva, slightly greenish. Dyar. Ent. Soc. Wash. Proc. 4: 414

Platynota sentana Clem. Am. Ent. Soc. Trans. 10: 23

Coleophora viburniella Clem., brownish, irregular alate case. Tineina N. A. p. 167

BAYBERRY

Insects

Acrobasis comptoniella Hulst., green larva with four rows of black spots. Am. Ent. Soc. Trans. 17: 125

Racheospila lixaria Guen. Ent. Am. 3: 72

Auletes cassandrae Lec., sweet fern. N. Y. Ent. Soc. Jour. 1: 36

Triachus atomus Suff. Ent. Soc. Wash. Proc. 2: 263

BLUEBERRY

Leaf feeders

Paonias astylus Dru., pale green, yellow lined, horned larva; low huckleberry, Rosaceae Fern. Sphing. N. E., p. 76

Anarta cordigera Thunb., reddish brown and white larva. Staint. Brit. Butterflies & Moths, 1: 293

Eudemis vacciniana Pack., brown or black headed, greenish larva. Pack. Guide, p. 339

Cymatophora pustularia Hübn., reddish, white and black lined spanworm. Staint. Brit. Butterflies & Moths, 2: 62

Macaria praeatomata Haworth, green, dark green lined spanworm. Pack. Monogr. Geometrid Moths, p. 291

Alceris minuta Rob., red or yellow headed, green larva, ½ in. Pack. Bul. 12, U. S. Div. Ent. p. 18

Scale insect

Eulecanium kingii Ckll. Fern. Coccidae, p. 189

HUCKLEBERRY

Leaf feeder

Datana drexelii Edw., black, yellow lined larva, 2¼ in. Pack. Monogr. Bombycine Moths, p. 112. Witch-hazel, linden

ANDROMEDA

Leaf feeder

Datana major Grote & Rob., black, stout, broken yellow or white lined larva. Psyche, 5:415

SQUAW HUCKLEBERRY (Vaccinium stamineum)

Leaf feeder

Datana palmii Beut., stout, black, yellow lined larva. Dyar. Ent. Am. 6:129

AZALEA

Leaf feeder

Amauronematus azaliae Marlt., shining, green solitary sawfly larva. Dyar. N. Y. Ent. Soc. Jour. 5:27

SHEEP LAUREL

Pseudanthonomus incipiens Dietz. N. Y. Ent. Soc. Jour. 1:80

INKBERRY (Ilex glabra)

Leaf feeder

Dolba hylaeus Dru., green, pink and yellow marked, horned larva, 2¼ in. Psyche, 5:267

WHITE ALDER

Leaf feeders

Nola clethrae Dyar, bluish ashen larva. Can. Ent. 31:62
Pyrausta thestialis Walk., brown headed, greenish white larva. Beut. Can. Ent. 20:15

VIRGINIA CREEPER

Leaf feeders

Adoxus obscurus Linn. Ent. Am. 6:176
Ampeloglypter ater Lec. N. Y. Ent. Soc. Jour. 1:85
Ampelophaga myron Cram., green, yellow dotted larva, 2 in. Beut. Am. Mus. Nat. Hist. Bul. 7:292
Pholus achemon Dru., green to brown, brown lined, horned larva, 3 in. Beut. Am. Mus. Nat. Hist. Bul. 7:289
Pholus pandorus Hübn., pale green larva with oval, cream-colored spots, 3 in. Beut. Am. Mus. Nat. Hist. Bul. 7:288
Sphecodina abbotii Swains, chocolate-brown, narrow, transverse lined larva, 2.21 in. Beut. Am. Mus. Nat. Hist. Bul. 7:283. Thorn

Amphion nessus Cr., chocolate-brown, checkered, black, horned larva, 2¾ in. Beut. Am. Mus. Nat. Hist. Bul. 7: 282
Triptogon lugubris Linn., pale green, dark green and yellow marked larva, 2.41 in. Beut. Am. Mus. Nat. Hist. Bul. 7: 281
Deidamia inscriptum Harr., greenish, yellow marked, horned larva, 2⅛ in. Soule. Psyche, 7: 317
Euthisanotia grata Fabr., red headed, bluish, orange and black banded larva, 1½ in. Saund. Ins. Inj. Fruits. p. 258
Acoloithus falsarius Clem., bluish black, orange and black marked larva, ¾ in. Glover. U. S. Com. of Agric. Rep't 1870, p. 81
Phyllocnistis ampelopsiella Chamb., narrow, much convoluted, linear mine resembling white blotch on under surface. Cinn. Quar. Jour. Sci. 2: 107
Antispila ampelopsiella Chamb., fat, white larva living first in linear, then a blotch mine. Psyche, 3: 149

Tree hopper

Telamona ampelopsidis Harr. Ent. Soc. Ont. 13th Rep't, p. 78

POISON IVY

Insects

Corymbites hamatus Say. Psyche, 4: 203

Leaf feeders

Pachybrachys tridens Melsh. Ent. Am. 6: 175
Epipaschia superatalis Clem., orange, black and blue lined larva. Dyar. N. Y Ent. Soc. Jour. 12: 249
Epipaschia zelleri Grote, yellow, gray and black lined larva. Dyar. N. Y. Ent. Soc. Jour. 12: 250
Lithocolletes guttifinitella Clem., broad, tortuous mine on upper surface. Pack. p. 665. Horsechestnut

SMILAX

Leaf feeders

Mitoma damon Cram., green, red spotted larva. French. Butterflies East. U. S. p. 268. Red cedar
Phiprosopus callitrichoides Grote, mahogany-red larva, 1 in. Daecke. N. Y. Ent. Soc. Jour. 11: 105
Phyllocnistis smilacisella Chamb., linear, white frass-lined mine; upper surface. Cinn. Quar. Jour. Sci. 2: 107

Sucking insects

Proleucoptera smilaciella Busck. N. Y. Ent. Soc. Jour. 8: 244
Chrysomphalus smilacis Comst. Fern. Coccidae, p. 294
Lachnus smilacis Auct., purplish gray, cottony aphid, sometimes very abundant

HONEYSUCKLE

Borers

Hypothenemus erectus Lec. W. Va. Agric. Exp. Sta. Bul. 31: 133
Hypothenemus eruditus Westw. W. Va. Agric. Exp. Sta. Bul. 31: 132

Leaf feeders

Hemaris diffinis Boisd. var. **axillaris** Gr. & Rob., pale green larva. Jewett. Bklyn Ent. Soc. Bul. 4: 17
Homohadena badistriga Grote. Can. Ent. 23: 35

TRUMPET VINE

Leaf feeder

Sphinx plebeia Fabr., olive-pink, olive-marked, horned larva; flesh-colored dots in transverse rows, $2^3/_5$ in. Beut. N. Y. Ent. Soc. Jour. 3: 58

BITTERSWEET

Leaf feeder

Zelleria celastrusella Kearf., leaf-green larva with darker dorsal line, $^2/_5$ in. N. Y. Ent. Soc. Jour. 11: 150

WILLOW

Borers

Agrilus politus Say. Am. Ent. Soc. Trans. 22: 364. Locust
Smodicum cucujiforme Say. Psyche, 4: 203. Hackberry
Mecas inornata Say, poplar. N. Y. Ent. Soc. Jour. 4: 81
Olethreutes capreana Hübn., bright green larva in willow shoots. Staint. Brit. Butterflies & Moths, 2: 194
Marmara salictella Clem., extremely long, narrow mine under delicate cuticle of twigs. Tineina N. A. p. 212

Leaf feeders

Cladius isomera Harr., black spotted larva. Harrington. Ent. Soc. Ont. 15th Rep't, p. 66
Priophorus irregularis Dyar, whitish larva with two irregular transverse rows of warts. N. Y. Ent. Soc. Jour. 8: 28
Pristiphora sycophanta Walsh. Pack.
Pontania pallicornis Nort., transparent green sawfly larva. Dyar. N. Y. Ent. Soc. Jour. 5: 196
Pteronus mendicus Walsh, leaf-green not shining sawfly larva. Dyar. Am. Ent. Soc. Trans. 22: 302
Pteronus odoratus Dyar, light green, segments 2, 12, 13 orange posteriorly. Can. Ent. 26: 187
Amauronematus similis Marlt., solitary translucent, light green sawfly larva; subdorsal line white. Dyar. N. Y. Ent. Soc. Jour. 5: 27
Amauronematus oregonensis Marlt., solitary whitish green, pilose sawfly larva; addorsal and stigmatal lines white. Dyar. N. Y. Ent. Soc. Jour. 5: 20
Amauronematus fur Walsh. Pack.
Pachynematus gregarious Marlt., whitish, black streaked slug-like larva. Dyar. N. Y. Ent. Soc. Jour. 5: 20
Dolerus arvensis Say, steel-blue sawfly frequents buds. Pack. p. 587
Dolerus bicolor Beauv., brownish yellow sawfly frequents buds. Pack. p. 588
Litargus tetraspilotus Lec. Pack.
Orsodachna atra Ahr. Ent. Soc. Wash. Proc. 2: 262

Chrysomela multiguttata Stal, hazel, elm, linden, alder. Ent. Soc Ont. 13th Rep't, p. 58
Chrysomela philadelphica Linn. var. **spireae** Say. Pack. p. 590
Pachybrachys livens Lec. Ent. Am. 6:175
Pachybrachys tridens Mels. Ent. Soc. Ont. 13th Rep't, p. 56. Sumac
Galerucella tuberculata Say. Am. Ent. Soc. Trans. 22:371
Hoplia trifasciata Say. Pack.
Phyllodecta vulgatissima Linn., poplar. Ent. Am. 6:176
Crepidodera helxines Linn. W. Va. Agric. Exp. Sta. Bul. 32:201. Wild cherry, thorn, poplar
Gastroidea cyanea Melsh. W. Va. Agric. Exp. Sta. Bul. 32:200
Nodonota tristis Oliv. Pack. p. 587
Macratria murina Fabr. Ins. N. J. p. 333
Rhynchites cyanellus Lec. Can. Ent. 23:21
Apion segnipes Say. N. Y. Ent. Soc. Jour. 1:39. Probably visits flowers
Lepyrus geminatus Say. Can. Ent. 23:23
Acalyptus carpini Herbst. N. Y. Ent. Soc. Jour. 1:43
Dorytomus squamosus Lec. Pack. (Anthonomus tessellatus Walsh)
Orchestes niger Horn. N. Y. Ent. Soc. Jour. 1:81
Orchestes pallicornis Say. N. Y. Ent. Soc. Jour. 1:81
Orchestes salicis Linn. N. Y. Ent. Soc. Jour. 1:81
Orchestes rufipes Lec. N. Y. Ent. Soc. Jour. 1:81
Elleschus bipunctatus Linn., poplar. N. Y. Ent. Soc. Jour. 1:81
Phloeophagus minor Horn. N. Y. Ent. Soc. Jour. 1:87. Beech, elm, ash, birch
Anthonomus sycophanta Walsh, gall feeder. N. Y. Ent. Soc. Jour. 1:80
Eurymus interior Scudd., greenish fuscous, with black points. Scudd. Butterflies East. U. S. & Can. p. 1105
Polygonia faunus Edw., brownish yellow, white spined caterpillar, $1\frac{1}{5}$ in. Beut. Am. Mus. Nat. Hist. Bul. 5:265. Gooseberry, birch, alder
Aglais milberti Godt., spiny, black larva; whitish tubercles. Scudd. Butterflies East. U. S. & Can. p. 420
Basilarchia arthemis Dru., green, reddish or whitish patched larva, $1\frac{2}{10}$ in.; elm, linden, poplar, birch. French. Butterflies East. U. S. p. 208
Thecla acadica Edw., green, oblique striped, greenish yellow larva. Saund. Can. Ent. 1:95
Thanaos icelus Lintn., red headed, greenish, white lined larva, $\frac{3}{5}$ in. Edw. Can. Ent. 17:98. Hazel, poplar
Thanaos persius Scudd., green, yellowish lined, white dotted larva, 1 in.; poplar. Beut. Am. Mus. Nat. Hist. Bul. 5:300
Sphinx luscitiosa Clem., green, white lined, horned larva, $2\frac{1}{2}$ in. Dyar. Ent. Am. 5:189
Marumba modesta Harr., green, granulated, horned larva with white points, 3 in.; poplar. Beut. Am. Mus. Nat. Hist. Bul. 7:312
Ecpantheria deflorata Fabr., locust. Ins. N. J. p. 398
Apatela lanceolaria Grote, green, black lined larva. Sm. & Abb. U. S. Nat. Mus. Proc. 21:171
Apatela connecta Gr., dark green, broad, yellow lined larva. Sm. & Dyar. U. S. Nat. Mus. Proc. 21:115
Apatela dactylina Grote, black, yellowish and brown haired larva; birch, alder. Sm. & Dyar U. S. Nat. Mus. Proc. 21:51

Apatela oblinita Sm. & Abb., velvety black, yellow dotted, hairy larva; alder. Sm. & Dyar. U. S. Nat. Mus. Proc. 21 : 169. Hazel

Apatela impressa Walk., velvety black, reddish striped larva; hazel. Sm. & Dyar. U. S. Nat. Mus. Proc. 21 : 159

Arsilonche albovenosa Goeze, black, yellow striped and dotted larva. Sm. & Dyar. U. S. Nat. Mus. Proc. 21 : 175

Calocampa curvimacula Morr., light brown, white striped larva. Dyar. Psyche, 8 : 336

Scoliopteryx libatrix Linn., pale green, yellow lined larva. Pack. p. 569

Catocala parta Guen., fawn-colored, black or brown marked larva, 2^{1}_{5} in. Pack. p. 570. Poplar

Catocala relicta Walk., dark greenish, black marked, humped larva, 2^{3}_{8} in. Clark. Can. Ent. 20 : 17. Poplar, birch

Catocala cara Guen., gray, brown marked, horned larva. Pack. p. 464. Poplar

Catocala concumbens Walk., brown, black marked larva, 2–2^{1}_{2} in. Pack. p. 570

Catocala briseis Edw. Can. Ent. 23 : 36

Catocala grynea Cram., silver gray, reddish, yellowish white marked larva, 2^{1}_{2} in. Bklyn. Ent. Soc. Bul. 4 : 22

Catocala babayaga Streck. Pack. p. 570

Homoptera minerea Guen. Can. Ent. 23 : 36

Homoptera lunata Dru. var. **edusa** Dru., dark gray larva with orange patches, 2^{1}_{5} in. Beut. N. Y. Ent. Soc. Jour. 9 : 192

Melalopha brucei Hy. Edw., black headed, purplish, white haired larva. Pack. Monogr. Bombycine Moths, p. 137

Harpyia borealis Boisd., red headed, yellow, brown marked, long tailed larva, 1^{3}_{4} in. Pack. Monogr. Bombycine Moths, p. 264. Wild cherry, poplar

Schizura concinna Abb. & Sm., black and white lined, reddish, red humped larva, 1^{1}_{4} in. Pack. Monogr. Bombycine moths, p. 212. general feeder

Schizura semirufescens Walk., white headed, brown and yellow marked larva with conspicuous dorsal processes on 1st, 5th, and 8th abdominal segments, 1^{1}_{2} in.; beech, maple, apple, poplar, birch. Pack. Monogr. Bombycine Moths, p. 210

Cerura occidentalis Lint., green, purple marked, long tailed larva, 1^{1}_{4} in. Pack. Monogr. Bombycine Moths, p. 268

Cerura scitiscripta Walk., greenish, purple marked, long tailed larva, 1 in.; wild cherry, poplar. Pack. Monogr. Bombycine Moths, p. 276

Ectropis crepuscularia Dennis & Schiff., brown headed, green, white marked spanworm. Pack. p. 371. Maple, poplar, alder

Hydriomena sordidata Fabr., depressed, brown, black and white marked spanworm. Pack. Monogr. Geometrid Moths, p. 96

Deilinia erythremaria Guen., green, white striped spanworm. Dyar. Psyche, 10 : 195. Poplar

Deilinia variolaria Guen., green, pink tinted or lined spanworm, $\frac{7}{8}$ in. Pack. p. 572

Eustroma testata Linn., gray brown, white striped spanworm; poplar, birch. Pack. Monogr. Geometrid Moths, p. 132

Cleora cribrataria Guen., poplar. Ins. N. J. p. 447

Cleora larvaria Guen., reddish, green tinted, black and white dotted spanworm. Beth. Can. Ent. 6 : 32. Wild cherry

Cleora pampinaria Guen., yellowish green, brown and black marked spanworm, 1 in. Pack. p. 571. Ash, maple, honey-locust

Euclea delphinii Boisd. var. **paenulata** Clem., brown, orange marked slug caterpillar, ½ in. Pack. p. 563
Phlyctaenia helvalis Walk., black headed, green larva, ⅝ in. Pack. p. 467. Poplar
Meroptera pravella Grote, green, light and dark green striped larva, ⅔ in. U. S. Div. Ent. Bul. 13:23
Epinotia augustana Hübn. Am. Ent. Soc. Trans. 10:47
Alceris ferrugana Schiff. Am. Ent. Soc. Trans. 10:8. Oak, beech, birch in Europe
Alceris logiana Schiff. var. **viburnana** Clem. Pack. p. 576
Alceris schalleriana Linn. Am. Ent. Soc. Trans. 10:8 (European record)
Alceris effractana Fro. Am. Ent. Soc. Trans. 10:5
Alceris permutana Dup., green, dark marked larva, ¾ in. Pack. p. 575. Rose in Europe
Alceris hastiana Linn., pale green larva between willow leaves. Staint. Brit. Butterflies & Moths, 2:233. Spruce in Europe
Phalonia dorsimaculana Rob. Staint. Brit. Butterflies & Moths, 2:191
Gracilaria salicifoliella Chamb., mines upper surface in August. Can. Ent. 4:25
Gracilaria stigmatella Fabr., greenish yellow larva, ¼ in., in linear or blotch mine or in roll at tip of leaf. Can. Ent. 13:25
Coptodisca saliciella Chamb., yellowish larva in spatulate mine. Psyche, 3:147. Wild cherry
Proleucoptera albella Chamb. Pack. p. 579. Poplar
Batrachedra praeangusta Haw. Pack. p. 584
Nepticula fuscotibiella Clem., mining under surface. Chamb. Psyche, 3:136
Lithocolletes salicifoliella Clem., mine on under surface, usually near base and along edge of leaf. Tineina N. A. p. 169

Sucking insects

Evacanthus acuminatus Fabr. Pack.
Pediopsis viridis Fitch. Ept. Am. 5:170
Cladobius salicti Harr., black, red legged, 1/12 in. Pack. p. 592
Cladobius flocculosus Weed. Am. Ent. Soc. Trans. 20:300
Cladobius salicis L. Am. Ent. Soc. Trans. 20:300
Chaitophorus nigrae Oest., dark brown aphid, 1/16 in. Pack. p. 593
Chaitophorus viminalis Mon., black, yellow marked aphid, 1/16 in. Pack. p. 592
Lachnus salicellis Fitch. Ins. N. J. p. 105
Lachnus dentatus LeB., dark, black spotted aphid on stems, 1/6 in. Pack. p. 592
Siphocoryne salicis Mon., dark or green with dark markings, 1½ in. Pack. p. 593
Aphis salicicola Thom. Pack.

Scale insects

Chionaspis ortholobis Comst. Fern. Coccidae, p. 221. Butternut, honey-locust, poplar, cottonwood
Chionaspis salicis-nigrae Walsh., tulip tree, dogwood, poplar. Fern. Coccidae, p. 225
Eulecanium capreae Linn., linden, plum, poplar. Fern. Coccidae, p. 183

Frequenter

Psocus rufus Walsh. Pack.

WILLOW GALLS

Twig galls

Euura orbitalis Nort., enlarged, lateral, monothalamous bud gall. Ent. Soc. Phila. Proc. 6:250

Euura nodus Walsh, smooth twig enlargement, one fourth to twice normal diameter. Ent. Soc. Phila. Proc. 6:253

Euura ovum Walsh, oval, monothalamous twig gall, on one side. Ent. Soc. Phila. Proc. 6:251

Cecidomyia cornuta Walsh, larva bores stems affected by *C. brassicoides*. Ent. Soc. Phila. Proc. 3:625

Cecidomyia coryloides Walsh, large, monothalamous, apical; resembling a bunch of hazelnuts. Ent. Soc. Phila. Proc. 3:588

Cecidomyia hordeoides Walsh, resembles four rowed barley, twig not enlarged as in *C. triticoides*. Ent. Soc. Phila. Proc. 3:599

Cecidomyia nodulus Walsh, smaller, though similar to *C. batatus*, but monothalamous. Ent. Soc. Phila. Proc. 3:599

Cecidomyia triticoides Walsh, polythalamous, woody, resembling a wheat head, $\frac{3}{4}$–$1\frac{1}{4}$ in. Ent. Soc. Phila. Proc. 3:598

Rhabdophaga batatas Walsh, irregular polythalamous swelling. Ent. Soc. Phila. Proc. 3:601

Rhabdophaga rhodoides Walsh, monothalamous roselike galls at tip of twigs. Ent. Soc. Phila. Proc. 3:586

Rhabdophaga siliqua Walsh, monothalamous solitary oval, apical woody gall, $\frac{1}{2}$–1 in. Ins. Galls Ind. p. 840

Leaf galls

Pontania borealis Marlt., solitary, smooth, reddish, pyriform, $\frac{1}{3}$ in., $\frac{2}{3}$ below. Dyar. N. Y. Ent. Soc. Jour. 6:121

Pontania consors Marlt., gregarious, hairy, spheric, near leaf base, $\frac{1}{3}$ in. Dyar. N. Y. Ent. Soc. Jour. 6:121

Pontania gracilis Marlt., green, spheric gall, equally on both surfaces. Dyar. N. Y. Ent. Soc. Jour. 5:197

Pontania terminalis Marlt., green swelling on upper surface. Dyar. N. Y. Ent. Soc. Jour. 5:24

Rhabdophaga brassicoides Walsh, bunches of oval, monothalamous, sessile galls, $\frac{3}{4}$–$2\frac{1}{4}$ in. Ent. Soc. Phila. Proc. 3:577

Rhabdophaga gnaphaloides Walsh, apical, solitary, subspherical, $\frac{1}{4}$–$\frac{1}{2}$ in. Ent. Soc. Phila. Proc. 3:583

Rhabdophaga strobiliscus Walsh, pine cone-shaped gall. Ent. Soc. Phila. Proc. 3:582

Cecidomyia verruca Walsh, small, monothalamous, irregularly spheric gall. Ent. Soc. Phila. Proc. 3:606

Phylloxera salicicola Perg., woolly aphids in bark crevices and leaf buds. Davenport. Acad. Sci. Proc. 6:267

Eriophyes salicicola Garm., longitudinal leaf folds. Pack. p. 505

Acarus aenigma Walsh, polythalamous, irregular, spheroidal, almost sessile mass of bud or leaf tissues, $\frac{1}{3}$–$1\frac{1}{10}$ in. Ent. Soc. Phila. Proc. 3:608

Acarus semen Walsh, small, roughened, greenish yellow, mostly on upper surface. Ent. Soc. Phila. Proc. 3:606

Inquilines

Cecidomyia albovittata Walsh, in various leafy, tip galls, R. strobiloides Walsh, etc. N. Am. Diptera, p. 159

Cecidomyia annulipes Walsh, in galls of R. strobiloides Walsh. Ent. Soc. Phila. Proc. 3:629

Cecidomyia atricornis Walsh, in galls of R. strobiloides Walsh. N. Am. Diptera, p. 159

Cecidomyia atrocularis Walsh, in galls of R. strobiliscus Walsh. N. Am. Diptera, p. 159

Cecidomyia orbitalis Walsh, in various willow galls. N. Am. Diptera, p. 160

Lestodiplosis septem-maculata Walsh, in galls of R. brassicoides Walsh. Ent. Soc. Phila. Proc. 3:630

Lestodiplosis decem-maculata Walsh, in galls of R. strobiloides Walsh. Ent. Soc. Phila. Proc. 3:631

Epinotia saliciana Clem., larva in willow galls. Am. Ent. Soc. Trans. 10:47

Epinotia salicicolana Clem., larva in willow galls. Am. Ent. Soc. Trans. 10:47

Enarmonia gallaesaliciana Riley, larva in willow galls. Pack. p. 576

Aristotelia salicifungiella Clem., larva mines willow cabbage gall. Tineina N. A. p. 262

Batrachedra salicipomonella Clem., white, black banded larva in willow gall, 38 in. Pack. p. 582. Poplar

POPLAR

Borers

Eros aurora Herbst. Pack.

Dicerca prolongata Lec. Ent. Am. 5:29

Agrilus granulatus Say. Pack. p. 443

Poecilonota cyanipes Say. Ent. Am. 5:30

Plectrodera scalator Fabr. Am. Ent. Soc. Trans. 23:112. Willow

Hyperplatys aspersus Say, hickory, chestnut, cottonwood. N. Y. Ent. Soc. Jour. 4:79

Zeugophora varians Cr. Am. Ent. Soc. Trans. 22:370

Saperda moesta Lec. Am. Ent. Soc. Trans. 23:151

Oberea tripunctata Swed. var. **mandarina** Fabr. N. Y. Ent. Soc. Jour. 4:81

Dorytomus mucidus Say. N. Y. Ent. Soc. Jour. 1:41. Pine

Memythrus dollii Neum. Ins. N. J. p. 471

Leaf feeders

Pontania populi Marlt., whitish larva with two dusky brown, corneous patches. Dyar. N. Y. Ent. Soc. Jour. 5:24

Pontania robusta Marlt., pale emerald-green larva. Dyar. N. Y. Ent. Soc. Jour. 5:195

Pteronus hudsonii Dyar, bluish green, orange-yellow blotched larva. Am. Ent. Soc. Trans. 22:306

Pteronus lombardae Marlt., larva indistinguishable from P. ventralis. Dyar. N. Y. Ent. Soc. Jour. 5:25

Camponiscus americana Marlt., whitish green dorsally, not shining; at rest, spirally curled. Dyar. N. Y. Ent. Soc. Jour. 5:23

Cryptocephalus leucomelas Suffr. Ins. N. J. p. 302

Chrysomela conjuncta Rog., gregarious, black larvae, 1/3 in. Pack. p. 470.
Wollastonia quercicola Boh. N. Y. Ent. Soc. Jour. 1:87
Raphia frater Grote, bluish green, yellow and red marked larva, 1½ in. Pack. p. 462. Willow
Apatela distans Grote, black, pale yellow haired larva; willow, birch, alder. Sm. & Dyar. U. S. Nat. Mus. Proc. 21:161
Apatela leporina Linn., thick, long, yellowish hair, 1 4/5 in. Pack. p. 461. Birch.
Apatela lepusculina Guen., yellow larva; 5 black hair pencils. Saund. Ent. Soc. Ont. 14th Rep't, p. 24
Apatela noctivaga Grote, black mottled, red banded larva. Sm. & Dyar. U. S. Nat. Mus. Proc. 21:156
Apatela populi Riley, yellowish, hairy larva with black hair pencils. Pack. p. 433
Apatela sperata Grote, pinkish or carmine, brown mottled, blackish larva; alder. Sm. & Dyar. U. S. Nat. Mus. Proc. 21:154
Catocala amatrix Hübn., gray or flesh-colored, black spotted larva, 3 in. Pack. p. 465
Catocala unijuga Walk., gray, white marked larva, 2 1/5 in. Pack. p. 463
Catocala meskei Grote, light drab, brown banded larva, 2½ in. Pack. p. 462
Plathypena scabra Fabr. U. S. Div. Ent. Bul. 32:55
Melalopha albosigma Fitch, yellow, gray lined larva, 1¼ in. Pack. N. Y. Ent. Soc. Jour. 1:27. Willow
Melalopha apicalis Walk., light brown or grayish larva with yellowish tubercles, 1¼ in. Pack. Monogr. Bombycine Moths, p. 125. Willow
Melalopha strigosa Grote, black headed, yellow and purple striped larva. Dyar. Psyche, 7:424
Gluphisia septentrionalis Walk., green, pink marked larva, 1¼ in.; willow, birch. Pack. Monogr. Bombycine Moths, p. 90. Elm, sweet gum
Pheosia dimidiata H.-S., reddish, slate gray, black horned larva, 1½ in.; willow. Pack. Monogr. Bombycine Moths, p. 158
Hyperaeschra stragula Grote, a slate or lilac colored, brown and golden marked larva with humps on the 2d, 3d and 8th abdominal segments, 2 in.; willow. Pack. Monogr. Bombycine Moths, p. 165
Harpyia scolopendrina Boisd., red headed, yellowish, purple marked, long tailed larva. Pack. Monogr. Bombycine Moths, p. 270
Epimecis virginaria Cram., red headed, yellowish, bluish green marked spanworm. Pack. Monogr. Geometrid Moths, p. 443
Lycia ursaria Walk., drab or dingy purple spanworm, 2–2½ in. Pack. p. 445. Elm, wild cherry
Metanema inatomaria Guen. Ins. N. J. p. 451
Anacampsis rhoifructella Clem., green, black spotted or brown, dark marked larva, 5/8 in. Pack. p. 468. Sumac
Gracilaria stigmatella Fabr., willow. Am. Ent. Soc. Trans. 10:102
Ancylis tineana Hübn. Am. Ent. Soc. Trans. 10:52
Coleophora cinerella Chamb. U. S. Div. Ent. Bul. 32:56
Phyllocnistis populiella Chamb., tortuous winding mine with central indistinct frass line. Cinn. Quar. Jour. Sci. 2:106
Lithocolletes populiella Chamb. Pack. p. 468
Proleucoptera albella Chamb., conspicuous mine in silver-leaved and lombardy poplars, separates the two cuticles. Can. Ent. 3:24

Sucking insects

Chaitophorus candicans Koch. Pack.
Chaitophorus populifoliae Fitch, chestnut-brown, black marked aphid, 1/5 in. Pack. p. 471
Chaitophorus populicola Thom. Pack. p. 434
Pemphigus popularius Fitch, brown, green, black marked aphid, 1/8 in. Pack. p. 472
Pemphigus populi-globuli Fitch, basal, globular leaf galls. Pack. p. 472
Pemphigus populimonilis Riley. Pack.
Pemphigus populiramulorum Riley. Pack.
Phemphigus populi-venae Fitch, yellow mid vein galls. Pack. p. 472
Pemphigus pseudobyrsa Walsh. Pack.
Phylloxera popularia Perg., in green deserted galls of Pemphigus populicaulis Fitch. Davenport. Acad. Sci. Proc. 9: 266
Phylloxera prolifera Oestl., occurs in deserted galls of Pemphigus populicaulis Fitch. Perg. Davenport. Acad. Sci. Proc. 9: 265

BIRCH

Borers

Campylus denticornis Kirby. Pack. p. 485
Gracilia minuta Fabr. Wickham. Can. Ent. 29: 110
Rhinosimus viridiaeneus Rand., under birch bark
Liodes basalis Lec., on woody fungus
Liodes globosa Lec., on woody fungus
Dorcatoma setulosum Lec., on woody fungus
Orchesia gracilis Melsh., fungi

Leaf feeders

Croesus latitarsus Nort., blue black larva; cherry. Harrington. Ent. Soc. Ont. 15th Rep't, p. 67
Hylotoma coerulea Nort., larva indistinguishable from H. pectoralis Leach. Dyar. Am. Ent. Soc. Trans. 22: 309
Pristiphora tibialis Nort., translucent, leaf-green, shining larva; willow, yellow birch. Dyar. Am. Ent. Soc. Trans. 22: 301
Strongylogaster pinguis Nort., not shining, yellowish olivaceous larva; oak, linden. Dyar. Am. Ent. Soc. Trans. 22: 311
Tenthredo cressonii Kirby, whitish green to yellowish green translucent larva. Dyar. Am. Ent. Soc. Trans. 22: 312
Tenthredo remota MacGill., whitish translucent larva, appearing yellowish green. Dyar. N. Y. Ent. Soc. Jour. 5: 19
Taxonus multicolor Nort., translucent waxy tinged vinous and tar-brown larva. Am. Ent. Soc. Trans. 22: 309
Pteronus ? lateralis Nort., dark, slightly shining green larva. Am. Ent. Soc. Trans. 22: 307
Pteronus latifasciatus Cress., purplish vinous tinted larva. Dyar. Am. Ent. Soc. Trans. 22: 304
Pteronus pinguidorsum Dyar, translucent green larva. Am. Ent. Soc. Trans. 22: 303
Pteronus hyalinus Marlt. U. S. Div. Ent. Bul. 3, t. s. p. 67
Syneta ferruginea Germ. Pack.
Aphrastus taeniatus Gyll. Pack.

Strophosomus coryli Fabr. N. Y. Ent. Soc. Jour. 1:42
Orchestes betuleti Horn. N. Y. Ent. Soc. Jour. 1:81
Apion walshii Smith. N. Y. Ent. Soc. Jour. 1:40
Eugonia j-album Bd.-Lec., light green, reddish and black, bristled larva, 2 in.; paper birch. Am. Mus. Nat. Hist. Bul. 5:266; willow, poplar
Drepana arcuata Walk., green, yellow and brown marked larva. Beut. Ent. Am. 5:38
Lophodonta ferruginea Pack., green, white lined larva; reddish dorsal line on 13th segment. Pack. Monogr. Bombycine Moths, p. 150
Apatela superans Guen., soft green larva; narrow, yellow subdorsal lined; mountain ash, apple. Sm. & Dyar. U. S. Nat. Mus. Proc. 21:110
Apatela betulae Riley, dull olivaceous brown, black and white haired larva, 1½ in. Sm. & Dyar. U. S. Nat. Mus. Proc. 21:75
Apatela impleta Walk., black and white mottled larva; oak, walnut, elm, ash, maple, linden, apple, cherry, willow, poplar. Sm. & Dyar. U. S. Nat. Mus. Proc. 21:152
Apatela xyliniformis Guen., blackish or gray, finely strigose, red banded larva. Sm. & Dyar. U. S. Nat. Mus. Proc. 21:166
Euplexia lucipara Linn., green, white marked larva, 1⅜ in. Pack. p. 497
Olene leucophaea Abb. & Sm. var. **basiflava** Pack. Can. Ent. 23:34
Cosymbia lumenaria Hübn., green, white marked larva, ⅞ in. Pack. p. 501
Demas propinquilinea Grote, white larva with red or black pencil on joint 3; oak, walnut, beech, maple. Sm. & Dyar. U. S. Nat. Mus. Proc. 21:20
Falcaria bilineata Pack., rusty brown larva, 1⅙ in. Dyar. N. Y. Ent. Soc. Jour. 2:108
Mesoleuca ruficillata Guen. Ent. Am. 3:49
Ectropis crepuscularia Denis & Schiff. Pack.
Oreta rosea Walk. Pack. Viburnum
Oreta irrorata Pack. Pack.
Priocycla armataria H.-S., black spanworm, ½ in.; maple, birch, currant. Saund. Can. Ent. 3:130
Rheumaptera hastata Linn., black or brownish black, black spotted, black and white marked spanworm; sweet gale. Pack. Monogr. Geometrid Moths, p. 164
Metrocampa praegrandaria Guen., green headed, brown, dark spotted spanworm. Dyar. Psyche, 10:190. Oak, hornbeam, elm, linden, willow, poplar
Brephos infans Mosch. Pack.
Depressaria betulella Busck. U. S. Nat. Mus. Proc. 24:746
Moodna pelviculella Hulst. Am. Ent. Soc. Trans. 17:104
Acrobasis betulella Hulst. Am. Ent. Soc. Trans. 17:125
Eucosma transmissana Walk. Pack.
Eucosma solicitana Walk. Pack.
Eucosma similana Hübn., hazel (in Europe). Am. Ent. Soc. Trans. 10:42
Exartema zellerianum Fern. Am. Ent. Soc. Trans. 10:29
Alceris ferrugana Schiff. Pack.
Alceris niveana Fabr. Am. Ent. Soc. Trans. 10:6

Sucking insects

Bythoscopus fenestratus Fitch. Pack.
Eutettix seminudus Say. Pack.
Corythuca juglandis Fitch. Pack.

Calaphis betulella Walsh. Pack.
Hormaphis papyraceae Oest. Pack.
Eulecanium websteri King. Fern. Coccidae, p. 198

ALDER

Borers

Dicerca pugionata Germ. Ent. Am. 5 : 30. Oak, maple
Tetrops canescens Lec. Am. Ent. Soc. Trans. 23 : 157
Eupristocerus cogitans Web. Ent. Am. 5 : 32

Leaf feeders

Kaliosysphinga dohrnii Tisch., slender, whitish leaf-mining larva, 1/12–1/3 in. Slingerland. Cornell Univ. Agric. Exp. Sta. Bul. 233 : 58
Amauronematus luteotergum Nort., shining green larva, yellowish beneath. Dyar. Am. Ent. Soc. Trans. 22 : 304
Poecilostoma inferentia Nort., smooth, shining, pale green larva. Dyar. Am. Ent. Soc. Trans. 22 : 308
Pteronus corylus Cress., slender, dark green larva. Dyar. Am. Ent. Soc. Trans. 22 : 306
Pteronus marlattii Dyar, shining green brown larva. Am. Ent. Soc. Trans. 22 : 305
Calligrapha scalaris Lec., white, red headed, humped larva, 1/4 in. Pack. p. 635. Wild plum
Monachus saponatus Fabr. Ent. Soc. Ont. 13th Rep't, p. 56
Papilio rutulus Boisd. Pack. p. 625
Apatela hastulifera Abb. & Sm., black, dark brown, haired larva, 1 2/5 in. Sm. & Dyar. U. S. Nat. Mus. Proc. 21 : 47. Linden
Mesoleuca truncata Hufn. Ent. Am. 3 : 50
Hemichroa americana Prov., yellowish larva. Dyar. Can. Ent. 25 : 244
Sabulodes arcasaria Walk., dark brown, silver-marked spanworm; 5th abdominal segment with double hump; 1 1/4 in. Pack. p. 628
Telphusa belangerella Chamb., amber-colored leaf roller, with long caudal hairs, 1/4 in. U. S. Div. Ent. Bul. 13 : 25
Acrobasis rubrifasciella Pack., brown, pinkish larva, 1/2 in. Hulst. Am. Ent. Soc. Trans. 17 : 124. Hickory
Gelechia corylisella Chamb., dull whitish larva, 1/4 in. Pack. p. 635
Lithocolletes auronitens Frey & Boll. Pack.

Aphid

Lachnus alnifoliae Fitch. Ins. N. J. p. 105

Bud gall

Dasyneura serrulatae O. S., deformed terminal, greenish or brown, with whitish efflorescence. Ent. Soc. Wash. Proc. 2 : 388

PINE

Borers

Urocerus flavicornis Fabr. Ent. Soc. Ont. 36th Rep't, p. 60
Chalcophora fortis Lec. Pack. p. 680
Buprestis consularis Gory. Ent. Am. 5 : 30
Buprestis lineata Fabr. Pack. p. 683
Buprestis sulcicollis Lec. Ent. Am. 5 : 30
Buprestis ultramarina Say. Pack. p. 682
Melanophila aeneola Mels. Ent. Am. 5 : 31
Chrysobothris blanchardi Horn. Ent. Am. 5 : 31
Chrysobothris harrisii Hentz. Pack. p. 680
Chrysobothris trinervia Kirby, spruce. Ent. Am. 5 : 31
Pityobius anguinus Lec., in pine woods, probably also on hemlocks
Laricobius erichsoni Rosen. Ent. Am. 6 : 155
Actenodes acornis Say. Ins. N. J. p. 255
Prionus pocularis Dalm. N. Y. Ent. Soc. Jour. 4 : 74
Callidium janthinum Lec. N. Y. Ent. Soc. Jour. 4 : 75
Romaleum simplicicollis Hald. Ins. N. J. p. 287
Euderces pini Oliv. N. Y. Ent. Soc. Jour. 4 : 77
Neoclytus muricatulus Kirby. N. Y. Ent. Soc. Jour. 4 : 76
Atimia confusa Say. N. Y. Ent. Soc. Jour. 4 : 77. Cedar
Leptostylus commixtus Hald. Pack. p. 697. Locust
Leptostylus sexguttatus Say. Wickham. Can. Ent. 29 : 208
Acanthocinus nodosus Fabr. Am. Ent. Soc. Trans. 23 : 132
Eupogonius tomentosus Hald. N. Y. Ent. Soc. Jour. 4 : 80. Hickory
Eupogonius pinivora Fitch. Pack. p. 696
Pytho niger Kirby, black spruce. W. Va. Agric. Exp. Sta. Bul. 32 : 204
Podapion gallicola Riley. N. Y. Ent. Soc. Jour. 1 : 40
Pachylobius picivorus Germ. Pack. p. 727
Hylobius confusus Kirby. Ent. Soc. Ont. 33d Rep't, p. 117
Hypomolyx pinicola Coup. Pack. p. 726
Magdalis lecontei Horn. Can. Ent. 23 : 24
Magdalis hispoides Lec. Ent. Am. 6 : 170
Copturodes longulus Lec. W. Va. Agric. Exp. Sta. Bul. 56 : 441
Cossonus concinnus Boh. Ent. Am. 6 : 172
Cossonus corticola Say. Ent. Am. 6 : 172. Spruce
Cossonus crenatus Horn. N. Y. Ent. Soc. Jour. 1 : 87
Cossonus piniphilus Boh. N. Y. Ent. Soc. Jour. 1 : 87
Monarthrum fasciatum Say, oak, hickory, beech, hemlock. Ins. N. J. p. 361
Gnathotrichus retusus Lec. W. Va. Agric. Exp. Sta. Bul. 31 : 128
Pityophthorus coniperda Schwarz. Ent. Soc. Ont. 33d Rep't, p. 117
Pityophthorus pullus Zimm. Ins. N. J. p. 362
Pityophthorus pulicarius Zimm. Ins. N. J. p. 362
Pityophthorus annectens Lec. Pack. p. 715
Pityophthorus confinis Lec. W. Va. Agric. Exp. Sta. Bul. 31 : 130
Pityophthorus cribripennis Eich. W. Va. Agric. Exp. Sta. Bul. 56 : 442
Pityophthorus hirticeps Lec. U. S. Nat. Mus. Proc. 25 : 56
Pityophthorus lautus Eich. W. Va. Agric. Exp. Sta. Bul. 31 : 131

Pityophthorus plagiatus Lec. W. Va. Agric. Exp. Sta. Bul. 31 : 129
Pityophthorus puberulus Lec. Ins. N. J. p. 362
Pityophthorus pulchellus Eich., spruce. W. Va. Agric. Exp. Sta. Bul. 56 : 442
Pityogenes plagiatus Lec. W. Va. Agric. Exp. Sta. Bul. 56 : 447
Pityogenes sparsus Lec. W. Va. Agric. Exp. Sta. Bul. 56 : 446
Xyleborus fuscatus Eich., oak, hickory, chestnut. Ins. N. J. p. 363
Xyloterus scabricollis Lec. W. Va. Agric. Exp. Sta. Bul. 56 : 444
Tomicus avulsus Eich. W. Va. Agric. Exp. Sta. Bul. 31 : 139
Dryocoetes affaber Mann. Can. Ent. 23 : 26. Spruce
Dendroctonus pusillus Gyll. Insect Life, 5 : 187. Spruce
Dendroctonus simplex Lec. Can. Ent. 23 : 27
Hylastes porculus Ehr. Pack. p. 724
Hylastes tenuis Zimm. W. Va. Agric. Exp. Sta. Bul. 56 : 449
Dryophthorus americanus Bedel. Ent. Am. 6 : 172
Dioryctria abietella Denis & Schiff. Am. Ent. Soc. Trans. 17 : 135

In dead wood or under bark

Mycetophagus pini Zeigl. Ins. N. J. p. 229
Melanotus cribulosus Lec. Ins. N. J. p. 250
Melanotus leonardi Lec. Ins. N. J. p. 250
Corymbites vernalis Hentz. Psyche, 4 : 203
Ernobius tenuicornis Lec. Pack. p. 727
Ernobius luteipennis Lec. Ins. N. J. p. 267
Ernobius granulatus Lec. Ins. N. J. p. 267
Helops aereus Germ. Ins. N. J. p. 324
Aradus cinnamomeus Panz. N. Y. Ent. Soc. Jour. 13 : 38

Leaf feeders

Lophyrus fabricii Leach, greenish, opaque white larva, with quadrate black spots. Dyar. N. Y. Ent. Soc. Jour. 5 : 200
Lophyrus pini-rigidae Nort., yellowish, black spotted, false caterpillar. Pack. p. 759
Lophyrus pinetum Nort., larva with "22 feet—6 true, 14 abdominal prolegs, and 2 anal. The body white, with 2 dorsal and 2 lateral rows of quadrate black spots the former running together. The head and true legs shining black. Length, about $\frac{3}{4}$ inch." Kirkpatrick. Ohio Farmer. Nov. 24, 1860 (From transcript supplied by the editors). *See* Am. Ent. Soc. Trans. 2 : 328–29.
Chrysomela philadelphica Lin. Pack. p. 801. Willow
Pachybrachys femoratus Oliv. Ent. Am. 6 : 175
Tachygonus lecontei Gyll. Ins. N. J. p. 354. Oak
Scythropus elegans Coup. N. Y. Ent. Soc. Jour. 1 : 39. Spruce
Cecidomyia inopis O. S., resinous cocoon on scrub pine leaves. Diptera N. A. 1 : 196
Incisalia niphon Hübn., slug-shaped, green, yellow striped larva, $\frac{3}{4}$ in. Beut. Am. Mus. Nat. Hist. Bul. 5 : 280. Juniper
Citheronia sepulchralis Gr. & Rob., brown, horned, red marked larva, 4 in. Pack. p. 772
Platagrotis condita Guen. Can. Ent. 23 : 35

Pheocyma lunifera Hübn., brown, black marked, 1⅝ in. Pack. p. 776
Therina pellucidaria Gr. & Rob., spanworm, whitish, black marked head; body greenish, brown and black lined. Dyar. Psyche, 9:21
Eufidonia notataria Walk., green, white striped spanworm, 1 in. Pack. p. 782. Tamarack, hemlock
Nepytia semiclusaria Walk., whitish, black marked spanworm, 1–1⅛ in. Pack. p. 781. Spruce, fir, tamarack, hemlock
Macaria praeatomata Haw. var. **bisignata** Walk., red headed, green spanworm, ¾ in. Pack. p. 780. Birch, fir
Caripeta angustiorata Walk., grayish brown, marbled spanworm, 1¼ in. Pack. p. 779
Paraphia subatomaria Wood, brown spanworm; June. Pack. p. 778. Beech, linden, birch, alder, spruce, fir
Melanolophia canadaria Guen., pine, spruce, tamarack, hemlock, sweet gale. Ins. N. J. p. 448
Alceris ferrugana Schiff., red or brown headed, green, red tinted leaf roller. Pack. p. 790
Lapara coniferarum Abb. & Sm., yellowish green, white lined larva, 3 in. Fern. Sphing. N. E. p. 84
Epinotia pinicolana Zell. Am. Ent. Soc. Trans. 10:47

Root feeder

Lachnosterna fusca Frohl. Pack. p. 675. Hickory

Sucking insects

Phlepsius fulvidorsum Fitch, hemlock. Am. Ent. Soc. Trans. 19:74
Melinna modesta Uhler. Ent. Am. 3:69
Tetyra bipunctata H.-S. N. Y. Ent. Soc. Jour. 13:30
Cixius pini Fitch, brownish black, smoky winged bug, ¼ in. Pack. p. 803
Livia vernalis Fitch, orange yellow, 1/16 in. Pack. p. 803
Schizoneura pinicola Thom., woolly aphids on tender shoots. Pack. p. 804
Chaitophorus pinicolens Fitch, yellow, white powdered aphid, ¼ in. Pack. p. 800
Lachnus strobi Fitch, dark, mealy aphids, ⅛ in. Pack. p. 741

SPRUCE

Borers

Cupes concolor West. Pack. p. 827
Melanophila longipes Say. Pack. p. 827. Pine
Melanophila drummondi Kirby. Ent. Am. 5:30
Chrysobothris scabripennis Lap. & Gory. Ent. Am. 5:31. Pine
Xestobium squalidum Lec., black spruce. W. Va. Agric. Exp. Sta. Bul. 32:189
Graphisurus pusillus Kirby. W. Va. Agric. Exp. Sta. Bul. 56:439
Pityophthorus tuberculatus Eich. W. Va. Agric. Exp. Sta. Bul. 31:132
Cryphalus piceae Ratz. W. Va. Agric. Exp. Sta. Bul. 56:444
Dryocoetes granicollis Lec., black spruce. W. Va. Agric. Exp. Sta. Bul. 31:138
Dendroctonus rufipennis Kirby. U. S. Div. Ent. Bul. 17, n. s. p. 67
Crypturgus alutaceus Sz., black and Norway spruce. W. Va. Agric. Exp. Sta. Bul. 56:448
Hepialus mustelina Pack. N. Y. Ent. Soc. Jour. 3:70

Leaf feeders

Oligia versicolor Grote, humped, red spotted larva, ½ in. Pack. p. 840. Black walnut, pine, fir
Epizeuxis aemula Hübn., brown, dark lined larva. Pack. p. 843
Hydriomena contracta Pack., green, white and yellow lined larva, ⅔ in.; pine, larch, juniper. U. S. Div. Ent. Bul. 12:21
Cleora cribrataria Guen. Pack. p. 841. Poplar
Therina fervidaria Hübn., yellowish, black lined larva. Pack. p. 841
Oxyptilus tenuidactylus Fitch. Pack. p. 851
Alceris variana Fern., red headed, greenish larva, ½ in. U. S. Div. Ent. Bul. 12:17
Tortrix packardiana Fern., fir. Pack. p. 849
Recurvaria piceaella Kearf., red larva with dorsal green patches; black spruce. N. Y. Ent. Soc. Jour. 11:155
Recurvaria obliquistrigella Chamb., reddish brown bud larva, ¼ in. U. S. Div. Ent. Bul. 12:21. Larch
Epinotia ratzeburgiana Sax, dark olive-brown bud larva; June. Pack. p. 845

Sucking insects

Bythoscopus variabilis Fitch, black, yellow and white marked, ⅕ in. Pack. p. 854. Birch
Lachnus abietis Fitch, black aphid, ⅛ in. Pack. p. 853
Chermes abieticolens Thom., apical, conelike deformities on twigs. Pack. p. 853.

HEMLOCK

Borers

Boletophagus corticola Say, under dead bark
Boletophagus depressus Rand., under dead bark

Leaf feeders

Feralia jocosa Guen., pea-green, checkered yellow and red larva, 1⅖ in.; spruce, balsam. Seifert. N. Y. Ent. Soc. Jour. 6:182
Sabulodes lorata Grote, brownish, white marked, tuberculate spanworm, 1½ in. Pack. p. 873
Caripeta divisata Walk., brownish, white, yellow marked larva. Pack. p. 874
Mesoleuca vasaliata Guen. Ins. N. J. p. 441
Scoparia basalis Walk. Ins. N. J. p. 461
Recurvaria apicitripunctella Clem., slender, green larva, ¼ in. Pack. p. 876

BALSAM

Leaf feeders

Panthea acronyctoides Walk.? Can. Ent. 23:35
Tephroclystis luteata Pack., reddish, white specked spanworm, ¾ in. Pack. p. 865. Hemlock
Archips afflictana Walk. Am. Ent. Soc. Trans. 10:13
Holcocera chalcofrontella Clem., leaf sheath worm. U. S. Div. Ent Bul. 32:54

LARCH OR TAMARACK

Leaf feeders

Hemichroa laricis Marlt., green striped larva. Dyar. N. Y. Ent. Soc. Jour. 5 : 28
Samia columbia Smith, light green tuberculate larva, 3 in. Pack. p. 801

Sucking insects and mite

Chermaphis laricifoliae Fitch., solitary, black and green aphid, 1/10 in. Pack. p. 903
Lachnus laricifex Fitch, solitary, brown, white marked aphid, 1/8 in. Pack. p. 902
Tetranychus telarius Linn., brown foliage bearing minute, globular mites. Pack. p. 903

CYPRESS

Gall

Cecidomyia ananassi Riley, brown, pineapplelike gall, 1/2 in. Am. Ent. 2 : 244

ARBOR VITAE OR WHITE CEDAR

Leaf feeders

Recurvaria thujaella Kearf., slender, dull red, purplish larva, 1/3 in. N. Y. Ent. Soc. Jour. 11 : 154
Bucculatrix thuiella Pack., brown headed, yellowish larva or white ribbed cocoon. Pack. p. 917

Scale insects and mite

Eulecanium pallidior Ckll. & Kg., brownish, hemispheric scale. Psyche, 8 : 340
Eulecanium fletcheri Ckll. Can. Ent. 25 : 221
Eriophyes thujae Garm. Pack. p. 920

JUNIPER OR RED CEDAR

Borers

Oeme rigida Say. Ins. N. J. p. 287
Leptura abdominalis Hald. N. Y. Ent. Soc. Jour. 4 : 78
Listronotus latiusculus Boh. W. Va. Agric. Exp. Sta. Bul. 32 : 205

Leaf feeders

Syssaura infensata Guen. var. **biclaria** Walk., brown, rough spanworm, 1 1/2 in. Pack. p. 907
Phalonia rutilana Hübn., webs containing yellowish larvae, 1/4 in. Pack. p. 910
Recurvaria juniperella Kearf., slender, dull green, pink tinged larva, 1/3 in. N. Y. Ent. Soc. Jour. 11 : 157

Sucking insect

Psallus juniperi Heid. N. Y. Ent. Soc. Jour. 13 : 49

EXPLANATION OF PLATES

PLATE 49

757

Wool sower, Andricus seminator Harr.

1 Two galls

Banded bullet gall, Holcaspis fasciata Bass.

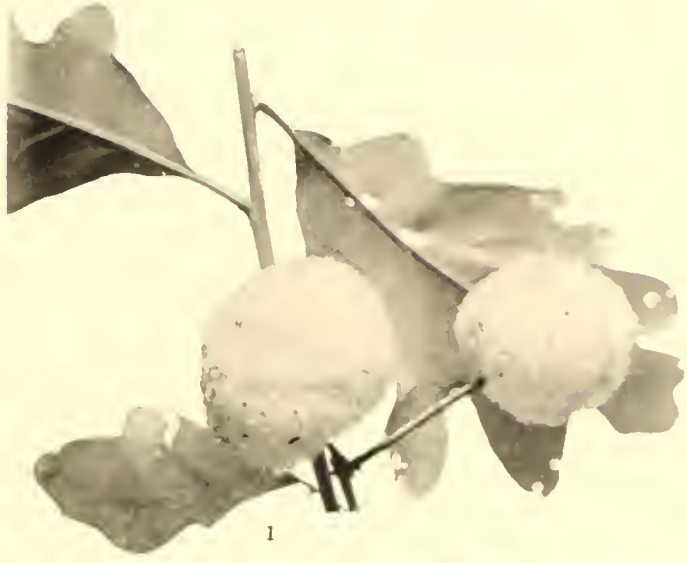
2 Probably two young galls of this species

Tomato sumac gall, Pemphigus rhois Fitch

3 Cluster of galls

Two marked tree hopper, Enchenopa binotata Say

4 Egg masses on viburnum, enlarged



1



3



2



4

Insect galls and tree bark insect eggs

PLATE 50

759

Larger oak apple gall, Amphibolips confluentus Harr.

1 Two galls on a small twig

Scrub oak gall, Amphibolips ilicifoliae Bass.

2 Two twigs bearing the peculiar fusiform galls

Poplar stem gall, Agromyza aeneiventris Fall

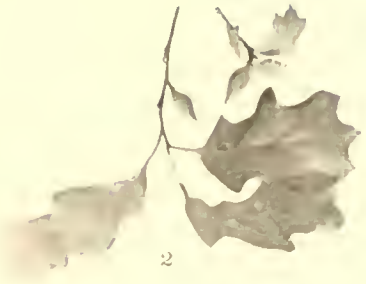
3 Several galls on twigs

Willow gall midge, Rhabdophaga salicis Shrank

4 Gall with pupal skins protruding therefrom



1



2



3



4

Insect galls

PLATE 51

761

Vagabond gall, *Pemphigus vagabundus* Walsh

1 Two galls on poplar twig

Andricus singularis Bass.

2 Upper gall on edge of leaf is this species

Woolly pine scale, *Pseudophilippia quaintancii* Ckll.

3 Infested twig



1



2



3

Insect galls and woolly pine scale

PLATE 52

763

Bark borer work at Bath-on-the-Hudson

The coarse writing bark beetle, Tomicus calligraphus Germ, was by far the most abundant and injurious in these white pines.



Work of bark borers, Bath-on-Hudson, in white pine

PLATE 53

765

Bark borer work at Bath-on-the-Hudson

1 Two white pines taken September 22, 1901

2 Same, photographed April 1902. These two illustrate the rapidity with which trees may be killed by bark borers. Tomicus calligraphus Germ. and T. pini Say were responsible for most of the injury.



Photo Sep. 28, 1901

1



Photo April 1901

2

Weeks of bark beetle injury, Pathway Hudson

PLATE 54

Coarse writing bark beetle, *Tomicus calligraphus* Germ.

1 Bare wood surface of white pine tree badly scored by galleries

2 Pitch tubes on the trunk of a badly infested tree

3 Borings showing the entrance or central chamber under a pitch tube, the adult and larval galleries

4 A pitch tube in profile



1



4



2



3

Work of coarse writing bark beetle in white pine

PLATE 55

769

Coarse writing bark beetle, Tomicus calligraphus Germ.

1 Inner aspect of badly eaten white pine bark
2 Several galleries preserved by infiltrated pitch
3 Internal aspect of badly scored bark
4 Portion of bark removed from a tree which had been dead some years, most of the galleries being preserved by infiltrated pitch



1 2 3 4

Work of coarse writing bark beetle in white pine

PLATE 56

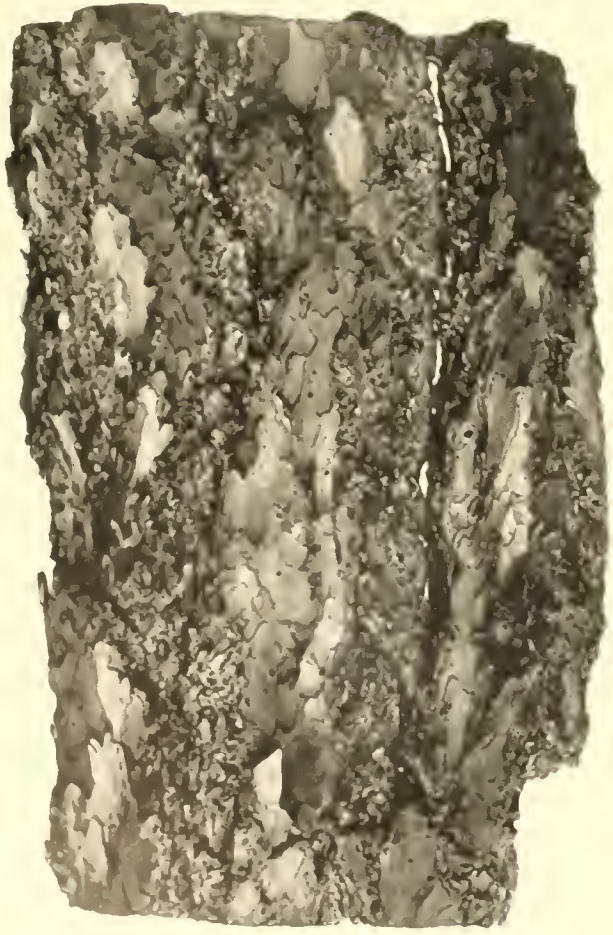
771

Coarse writing bark beetle, *Tomicus calligraphus* Germ.

1 Piece of white bark showing exit holes

2 Base of a badly infested tree from which bark illustrated at figures 1 and 3, was taken

3 Same as 2, except that a portion of the bark has been removed to show the condition beneath



1



2



3

Work of coarse writing bark beetle in white pine

PLATE 57

773

Pine bark borer, Tomicus pini Say

1, 2 Advanced stage of work in white pine

3 Portion of a typical mine showing in places the work of young Monohammus larvae



1



3



2

Work of bark borer in white pine

PLATE 58

775

Pine bark borer, Tomicus pini Say

1 Early work in white pine bark

2 Work in a more advanced stage

Balsam bark borer, Tomicus balsameus Lec.

3 Early work as shown on the surface of the wood

Turpentine bark beetle, Dendroctonus terebrans Oliv.

4 Work at the base of a tree, showing main gallery with its pitch-lined walls



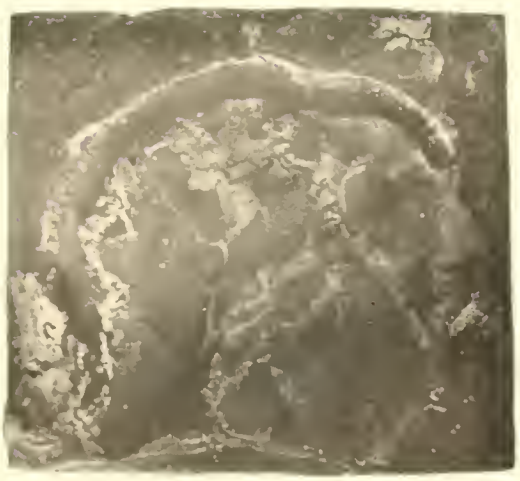
1



2



3



4

Work of pine bark borers

PLATE 59

777

Pine bark borer, Tomicus pini Say

1 Surface of white pine bark showing numerous exit holes and small pitch tubes

2 Internal aspect of the same piece of bark showing galleries of Tomicus and young Monohammus and also exit holes

The light background used in both photographs, makes the exit holes appear as white spots



1

2

Work of pine bark borer in white pine

PLATE 60

779

Southern Tomicus, Tomicus cacographus Lec.

1 Early operations in hard pine

2 Same, in a more advanced stage

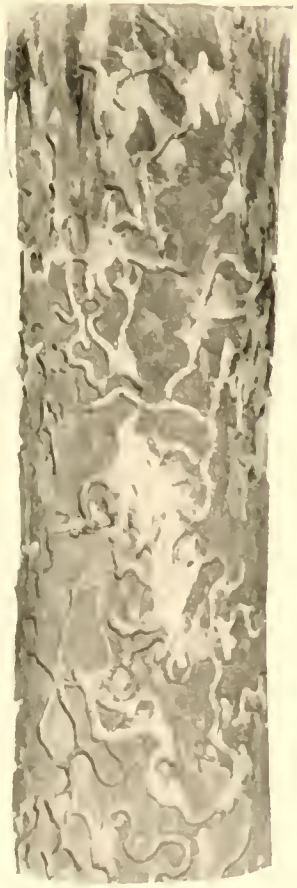
3 Thick bark badly eaten by this species

Coarse writing bark beetle, Tomicus calligraphus Germ.

and

Ribbed pine borer, Rhagium lineatum Oliv.

4 Work under white pine bark, the characteristic pupal cells showing very well



2



3



4



1

Work of pine bark borers

PLATE 61

781

Spruce destroying beetle, Dendroctonus piceaperda Hopk.

1 Internal aspect of badly mined spruce bark. This view shows the longitudinal adult gallery and the numerous irregular dilating ones made by the larvae.

2 Interior view of bark showing several longitudinal adult galleries preserved by infiltrated pitch, and also two ventilating burrows, the latter showing light, owing to the white background

Blue pine borer, Callidium antennatum Newm.

3 Hard pine branch showing characteristic mines



1



2



3

Work of spruce-destroying beetle and blue pine borer

PLATE 62

783

Balsam bark borer, Tomicus balsameus Lec.

1 Advanced stage of work in bark

2 A small gallery in bark

3 Portion of galleries in wood, showing the same borings as represented in 1

4 Portion of wood from which the outer bark has been removed, showing very badly riddled, probably decaying tissues

5 Wood rather badly carved by adult galleries



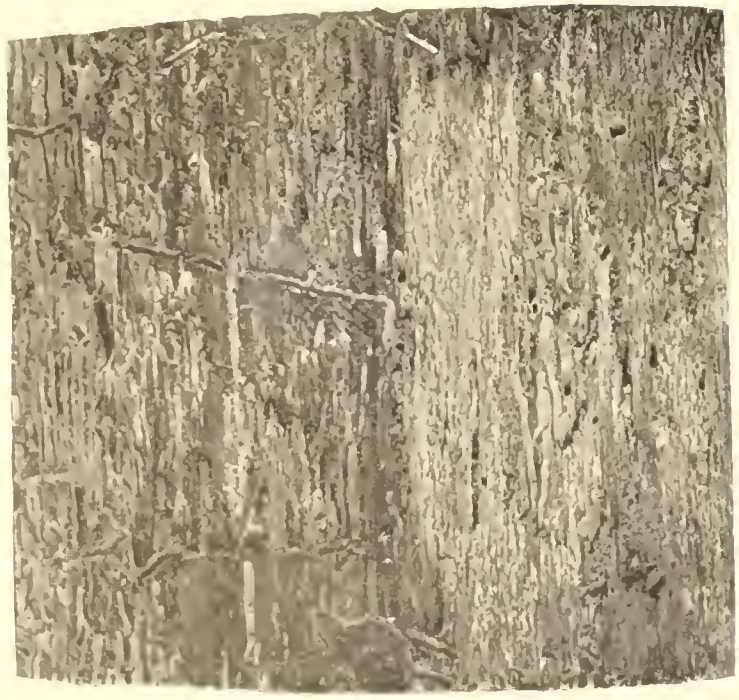
1



2



3



4



5

Work of balsam bark borer in balsam

PLATE 63

785

Sawyer, Monohammus confusor Kirby

1 Adult, much reduced

Urographis fasciatus DeG.

2 Adult

White-spotted sawyer, Monohammus scutellatus Say

3 Adult

Red cedar bark beetle, Phlocosinus dentatus Say

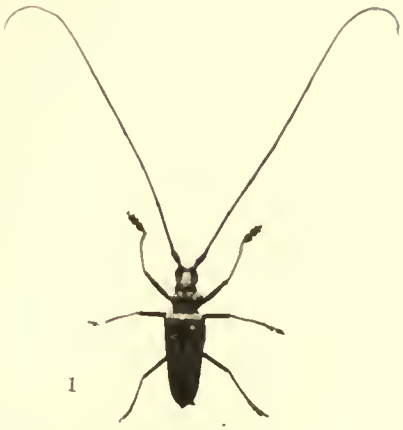
4 Typical gallery in Arbor vitae

Pityogenes sp.

5 Work in white pine

Pityophthorus sp.

6 Work under hard pine bark, and probably that of Callidium antennatum Newm.



1



2



3



4



5



6

Borers and borer work

PLATE 64

Ribbed pine borer, Rhagium lineatum Oliv.

1 Beetle slightly enlarged
4 Pupa slightly enlarged
7, 8, 10 Pupal cells
11 Larva or grub
12 Pupa in cell

Pytho americanus Kirby

2 Beetle slightly enlarged
3 Pupa slightly enlarged
5 Pupa in cell
6, 9 Pupal cells



Rhagium and Pyrochroa

PLATE 65

789

Tomicus sp.

1 White pine killed by bark borers in 1900, at Lansingburg N. Y., photo October 1902, showing the rapidity with which injured trees decay

White pine weevil, Pissodes strobi Peck.

2 Deformed hard pine at Salem N. Y., photo October 1902



Photo. Oct. 1902

1



Photo. Oct. 1902

2

Bark borer and pine weevil work

PLATE 66

791

Scolytid antennae

1 Phloeotribus liminaris Harr. x 110
2 Pityogenes sp. x 110
3 Phloeotribus frontalis Oliv. x 110
4 Tomicus balsameus Lec. x 110
5 T. caelatus Lec. x 110
6 T. cacographus Lec. x 110
7 T. pini Say. x 110
8 T. calligraphus Germ. x 110
9 T. integer Lec. x 110
10 Dendroctonus terebrans Oliv. x 80



Scolytid antennae

PLATE 67

793

Scolytid antennae

1 Monarthrum mali Fitch. x 110
2 Pityogenes sp. x 110
3 Cryphalus striatulus Mann. x 110
4 Gnathotrichus materiarius Fitch. x 110
5 Pityogenes ponderosae Hopk. x 110
6 Hylesinus opaculus Lec. x 110
7 Phloeosinus dentatus Say. x 110
8 Polygraphus rufipennis Kirby. x 110
9 Chramesus hicoriae Lec. x 110
10 Scolytus rugulosus Ratz. x 110
11 Pityophthorus minutissimus Zim. x 110
12 Pityogenes sp. x 110
13 Xyleborus dispar Fabr. x 110
14 X. celsus Eich. x 110
15 Scolytus quadrispinosus Say. x 110
16 Pityogenes sp. x 110
17 Dryocoetes sp. x 110



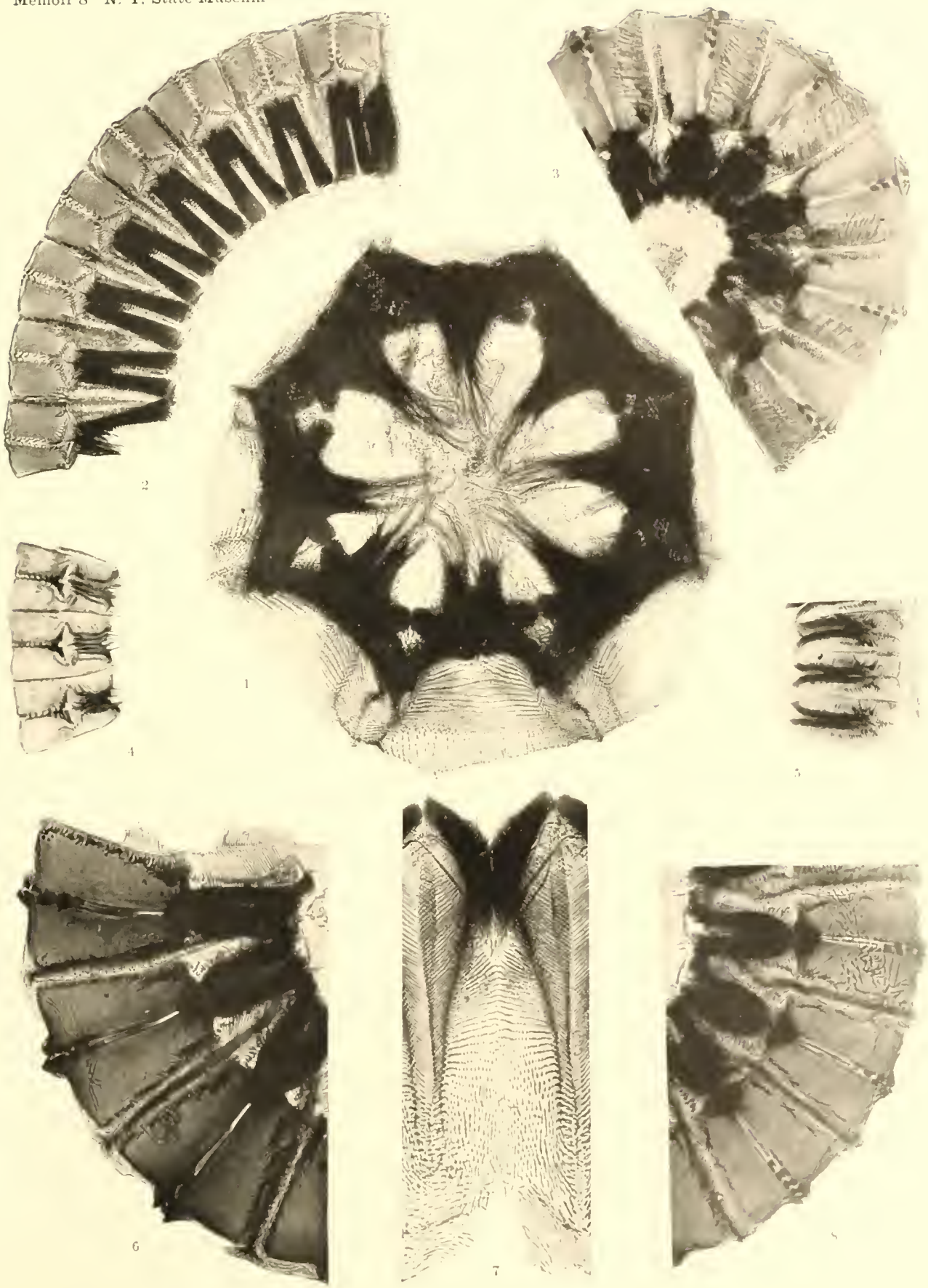
Scolytid antennae

PLATE 68

795

Scolytid proventriculi

1 Dendroctonus piceaperda Hopk., end view. x 110
2 Tomicus caelatus Eich., internal aspect of flattened segments. x 110
3 Tomicus cacographus Lec., internal aspect of flattened segments. x 110
4 Pityogenes species, internal aspect of flattened segments. x 110
5 Xylocleptes species, internal aspect of flattened segments. x 110
6 Tomicus calligraphus Germ., internal aspect of flattened segments. x 110
7 Dendroctonus terebrans Oliv., internal aspect of flattened segments. x 110
8 Tomicus pini Say, internal aspect of flattened segments. x 110



Scolytid proventriculi

PLATE 69

Scolytid proventriculi

1 Pityogenes species, internal aspect of flattened segments. x 110

2 Tomicus balsameus Lec., end view. x 110

3 Gnathotrichus materiarius Fitch, internal aspect of flattened segments. x 110

4 Phloeosinus dentatus Say, internal aspect of flattened segments. x 110

5 Polygraphus rufipennis Kirby, end view. x 110

6 Chramesus hicoriae Lec., internal aspect of flattened segments. x 110

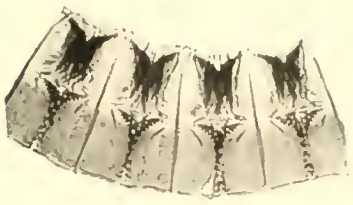
7 Xyleborus celsus Eich., internal aspect of flattened segments. x 110

8 Xyloterus lineatus Kirby, internal aspect of flattened segments. x 110

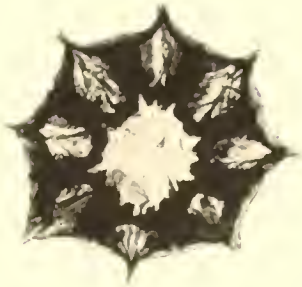
9 Dryocoetes autographus Ratz., internal aspect of flattened segments. x 110

10 Tomicus integer Eich., internal aspect of flattened segments. x 110

11 Dryocoetes sp., internal aspect of flattened segments. x 110



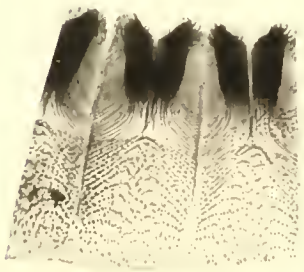
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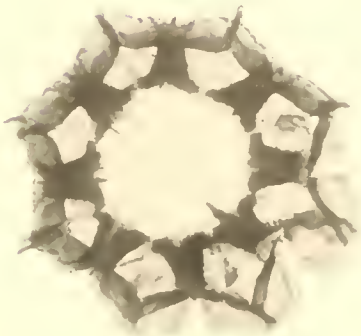
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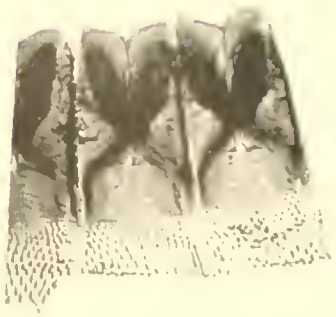
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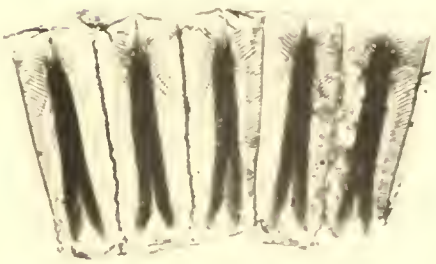
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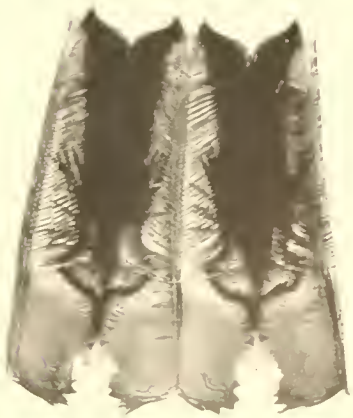
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9



10



11

Scolytid proventriculi

PLATE 70

Scolytid structures

1 Xyloterus sp. antenna. x 110

2 Xyloterus lineatus Kirby, right antenna. x 110

3 Xyloterus sp., inner aspect of flattened segments of proventriculus. x 110

4 Xyloterus politus Say, antenna. x 110

5 Xyloterus politus Say, inner aspect of flattened segments of proventriculus. x 110



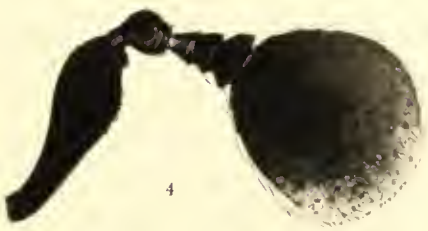
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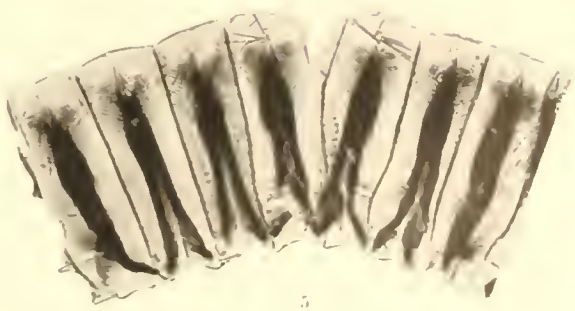
2



3



4



5

Scolytid structures

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ERRATA

Page 74, line 12 from bottom, for Entelus, read Eutelus.

Page 105, line 3 from bottom, for Kaliosyphinga, read Kaliosysphinga.

Page 162, line 15, for *Kaliosyphinga*, read *Kaliosysphinga*.

Page 163, legend, figure 23, for Kaliosyphinga, read Kaliosysphinga.

Page 163, line 7 from bottom, for 257, read 237.

Page 214 and 229, for Comstock, J. A., read Comstock, J. H.

Page 233, line 4 from bottom, for Emily G., read Emily L.

Page 239, line 3, for Leptocorus, read Leptocoris.

Page 278, line 11, for Spathina, read Spathius.

Page 301, line 6 from bottom, for Polygonotus, read Polygnotus.



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